TM 11-6625-2461-15

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT,
GENERAL SUPPORT, AND DEPOT MAINTENANCE
MANUAL INCLUDING REPAIR PARTS AND
SPECIAL TOOLS LISTS

PLUG-IN SPECTRUM ANALYZERS

NELSON-ROSS MODELS 230 AND 231

HEADQUARTERS, DEPARTMENT OF THE ARMY
MAY 1972

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WASHINGTON, D.C., *3 May 1972*

Operators, Organizational, Direct Support, General Support, and Depot Maintenance Manual Including Repair Parts and Special Tools Lists

PLUG-IN SPECTRUM ANALYZERS, NELSON-ROSS MODELS 230 AND 231

			Paragraph	Page
CHAPTER 1.		INTRODUCTION		
Section	I.	General		
		Scope	1-1	1-1
		Indexes of Equipment Publications	1-2	1-1
		Forms and Records	1-3	1-1
	II.	Description and Data		
		General	1-4	1-1
		Technical Characteristics	1-5	1-3
		Items Comprising an Operable Equipment	1-6	1-5
CHAPTER 2.		OPERATION		
Section	I.	Controls		
		Inspection and Installation	2-1	2-1
		Initial Adjustments	2-2	2-1
		Functions of Controls	2-3	2-1
	II.	Applications		
		General	2-4	2-5
		Distortion Analysis	2-5	2-5
		Intermodulation Distortion Percentage	2-6	2-5
		Typical Displays	2-7	2-5
CHAPTER 3.		CIRCUIT DESCRIPTION		
		General	3-1	3-1
		Block Diagram Description	3-2	3-1
		Detailed Circuit Description	3-3	3-1
4.		MAINTENANCE		
		General	4-1	4-1
		Preventive Maintenance	4-2	4-1
		Troubleshooting	4-3	4-1
		Tube Voltage Charts	4-4	4-2
		Alignment	4-5	4-3
APPENDIX A.		REFERENCES		A-1
B.		MAINTENANCE ALLOCATION		B-1
C.		ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS		C-1

LIST OF ILLUSTRATIONS

Figure No.	Title	Page
1–1	Spectral Display Characteristics	1–2
2–1	Model PSA 230, Controls and Functions	2–2
2–2	Model PSA 231, Controls and Functions	2–3
2–3	Typical Displays	2–6
3–1	Plug-In Spectrum Analyzers, Block Diagram	3–2
4–1	Alignment Controls, Top Chassis	4–3
4–2	Alignment Controls, Bottom Chassis	4–4
4–3	Internal Local Oscillator Adjustment	4–5
4–4	1-kHz-Per-Centimeter Scan Width Display	4–6
4–5	60-db Logarithmic Display	4–6
4–6	Intermodulation Distortion, Test Setup	4–8
4–7	Input Attenuator, Schematic Diagram	4–8
4–8	Model PSA 230, Schematic Diagram	Fold-in
4–9	Model PSA 231, Schematic Diagram	Fold-in

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 310–3, Military Publications. This manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual includes operation and maintenance instructions for the Nelson-Ross Plug-In, Low Frequency Spectrum Analyzers models 230 and 231 (PSA 230 and PSA 231). It covers operator's, organizational, direct support (DS), general support (GS), and depot maintenance.

b. The maintenance allocation chart (MAC), and the repair parts and special tool lists are included as appendixes B and C respectively.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. Report of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD form 6 (Report of Packaging and Handling Deficienceis) as prescribed in AR 700-58 (Army)/NAVSUP Publication 378 (Navy)/AFR 71-4 (Air Force)/and MCO P4030.29 (Marine Corps).

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38 (Army)/NAVSUP PUB 459 (Navy)/AFM 75-34 (Air Force)/and MCO P4610.19 (Marine Corps).

d. Reporting of Equipment Manual Improvements. The reporting of errors, omissions, and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, US Army Electronics Command, ATTN: AMSEL-MA-C, Fort Monmouth, N.J. 07703.

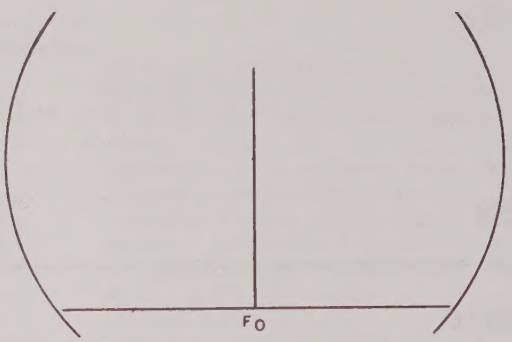
Section II. DESCRIPTION AND DATA

1-4. General

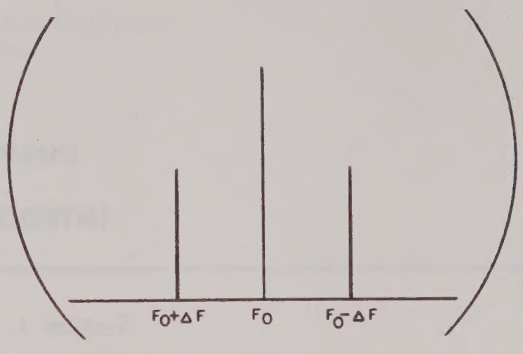
a. These plug-in spectrum analyzers are designed to provide coverage of the commonly used communications frequencies. Featuring extremely low levels of internally generated distortion, precision calibrated horizontal scan factors (cycles per centimeter), a 60-db logarithmic display and a calibrated input attenuator, these analyzers are ideal for design, test, and service of all types of narrow band communication systems and components.

b. These units are designed so that they may be conveniently plugged into any Hewlett-Packard type 140A oscilloscope. By simply installing one of these plug-ins, the oscilloscope becomes a complete spectrum analyzer. In use, the plug-in unit provides both vertical and horizontal deflection signals for the oscilloscope. All voltages for spectrum analyzer operation are obtained automatically when the plug-in unit is plugged into the oscilloscope.

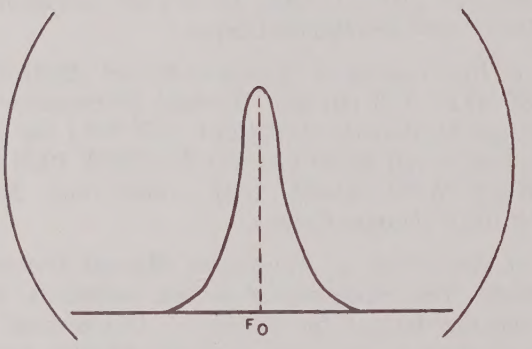
c. Before installing or operating the plug-in spectrum analyzer it is important to have a clear understanding of the nature and interpretation of the spectral display it will provide. The conventional use of an oscilloscope is to present a display of the amplitude/time characteristic of an electrical signal. In such a presentation the horizontal axis of the cathode ray tube represents time and the vertical axis represents instanta-



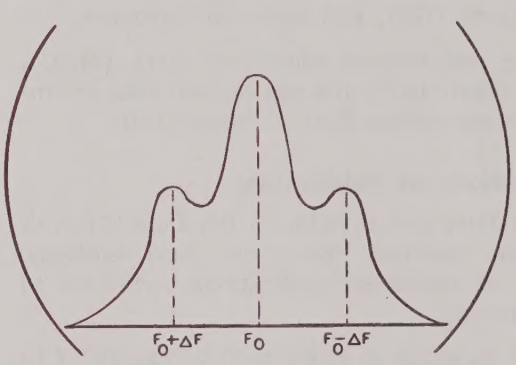
A— C W SIGNAL AS SEEN ON IDEAL SPECTRUM ANALYZER



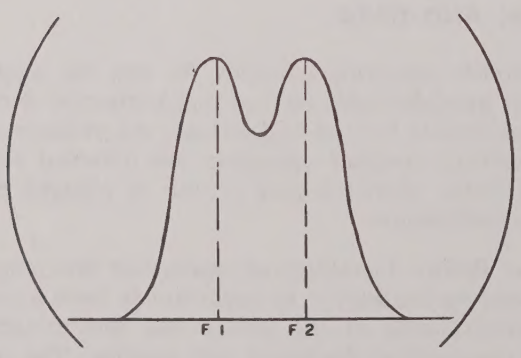
B— MODULATED SIGNAL ON IDEAL ANALYZER



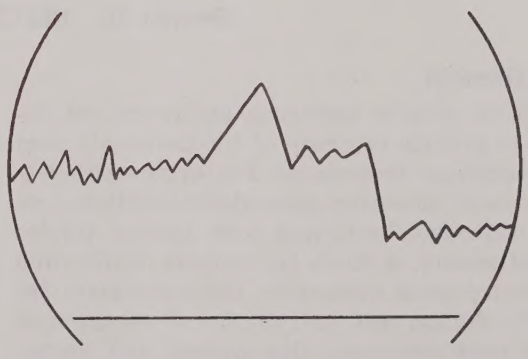
C— C W SIGNAL AS SEEN ON REAL ANALYZER



D— MODULATED SIGNAL ILLUSTRATING EFFECT OF RESOLUTION



E— TWO EQUAL SIGNALS JUST RESOLVED



F— CONTINUOUS SPECTRUM

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Figure 1-1. Spectral display characteristics.

neous amplitude. An equally meaningful display, commonly called a spectral display, is one in which the horizontal axis represents frequency and the vertical axis represents rms amplitude. This is the type of display provided by the PSA 230 and PSA 231.

d. The nature of the spectral display can be understood with the aid of the following illustrative examples:

(1) On an ideal spectrum analyzer, a signal containing energy at only one frequency will appear as a single vertical line on the display. This is illustrated in A, figure 1–1.

(2) Multiple signals would then appear as multiple vertical lines, however close in frequency they may be. A carrier modulated by sidebands at plus and minus a small frequency increment would thus appear as in B, figure 1–1.

(3) Since an ideal situation is not possible, a spectrum analyzer cannot present an infinitely narrow vertical line. Instead the signal is broadened into a pulse as in C, figure 1–1. Similarly, multiple signals closer together than the width of the pulse will tend to blend as in D, figure 1–1. This illustrates a basic spectrum analyzer parameter which must be considered, resolution. The smallest frequency difference between two equal amplitude signals which can be displayed is defined as the resolution of the analyzer. Two equal amplitude signals are considered resolved when they are far enough apart to cause a 3-db dip to appear between them. This is illustrated in E, figure 1–1.

(4) Signals containing components closer together than the resolution of the analyzer generate a continuous spectrum, as illustrated in F, figure 1–1.

e. There are three basic parameters to any spectrum analyzer display—

(1) *Resolution.* Resolution is defined in *d*(3) above.

(2) *Dispersion.* Dispersion is the width of the display (in frequency) on the cathode ray tube.

(3) *Scan time.* Scan time is the amount of time taken to scan the dispersion mentioned above. Since the three parameters are interrelated it is important to understand the manner in which they affect one another. Scan time and dispersion may be combined to produce a factor called sweep rate (cycles per second per second) which may not be exceeded for any given resolution. Expressed mathamatically—

$$\frac{\text{Dispersion}}{\text{Scan time}} \leq \text{(K) Resolution}$$

If this relationship is violated, either by reducing the scan time (increasing sweep speed) or by increasing the dispersion, the signal will smear and lose amplitude. Contrary to conventional oscilloscope operation, spectrum analyzers produce better displays with slower sweep speeds. Since the PSA 230 and PSA 231 units fit oscilloscopes with high sweep speed capabilities, the operator must remember to reduce the sweep speed sufficiently to obtain a good display. As a rule of thumb, the upper limit for any spectrum analyzer is three to five sweeps per second and many low frequency analyzers will require scan times in excess of 5 seconds.

f. The relationships mentioned above are of particular importance when making relative amplitude measurements. If the scan time, dispersion, or both are varied during a measurement *(for example,* while searching for a harmonic or spurious signal), the sensitivity may vary. It is wise, therefore, to reduce the dispersion (or increase the scan time) until the signal amplitude is no longer attenuated by these effects before taking readings. As the dispersion is reduced (or scan time increased) the amplitude of the component under observation will increase until a point is reached where further changes no longer have any effect. At this point a reading of amplitude may be taken.

1–5. Technical Characteristics

The technical characteristics of the PSA 230 and PSA 231 are listed in the charts below. The cart in *a* below, lists the characteristics which differ between the two models; the characteristics common to the two models are given in *b* below.

a. Differences Between Models.

Specification	PSA 230	PSA 231
Frequency range	500 kHz to 100 MHz	Same as PSA with external local oscillator; 600 kHz to 36 MHz with internal local oscillator at specified sensitivities and to 108 MHz with harmonics at reduced sensitivity.

Specification	PSA 230	PSA 231
Center frequency	500 kHz	500 kHz when used with external local oscillator.
Frequency tuning range	None	Four bands: 0.6 to 1.7 MHz 1.7 to 5.5 MHz 5.5 to 16 MHz 16 to 36 MHz
Internal local oscillator accuracy		± 5% slide rule dial calibrated to read directly in center frequency
Input attenuator	42 db in 1-db steps	51 db in 1-db steps

b. Technical Characteristics.

Frequency range ---- Refer to *a* above.
Center frequency ---- Refer to *a* above.
Fine tuning ---- ± kHz by means of multiturn control.
Scan width (Hz/cm) ---- 10 kHz, 2 kHz, 1 kHz, 500 Hz, 100 Hz, 50 Hz and 10 Hz.
Scan width accuracy ---- ±10%.
Resolution ---- Automatically programed with scan width:

Scan Width	*Resolution*
10 kHz	2 kHz
2 kHz	2 kHz
1 kHz	100 Hz
500 Hz	100 Hz
100 Hz	35 Hz
50 Hz	10 Hz
10 Hz	10 Hz

Frequency tuning range ---- Refer to *a* above.
Internal local oscillator Accuracy ---- Refer to *a* above.
Sensitivity ---- Direct: −106 dbm minimum
Conversion: −100 dbm minimum with local oscillator power.
Local oscillator input power ---- −6 dbm minimum, +20 dbm maximum (internal local oscillator in PSA 231 automatically supplies required power).
Input attenuator ---- Refer to *a* above.
Input attenuator accuracy ---- ±5%.
IF gain control ---- 20 db (nominal).
Input signal level ---- −100 dbm (threshold) to −40 dbm (full scale in log).
Input impedances and connectors ---- Local oscillator: 50-ohm BNC.
Signal input ---- 50-ohm BNC.
Display ---- Linear or 60 db log.
Display linearity ---- ±10%.
Dynamic range ---- Harmonic and intermodulation products at least 60 db below two equal full scale signals.
Display flatness ---- ±1 db in all scan width ranges except ±2 db in 10-kHz/cm range.
Video filter ---- 66 milliseconds, switch selectable.
Sweep speeds ---- Automatically programed with SCAN WIDTH switch, 60 DB LOG-LINEAR switch and VIDEO FILTER switch
Maximum: 8 sweeps/second (nominal)
Minimum: 15 seconds/sweep (nominal).
Fast sweep ---- Pushbutton defeats sweep speed controls to provide fast sweep for convenience in tuning.
Vertical output ---- 0 to 1 volt from 10 kHz maximum (nominal); dc coupled, BNC connector.
Horizontal output ---- 0 to 1 volt from 10 kHz maximum (nominal); dc coupled, BNC connector.

1–6. Items Comprising an Operable Equipment

FSN	Item	Quantity	Height (in.)	Depth (in.)	Width (in.)	Weight (lb)
None	Nelson-Ross Plug-in Spectrum Analyzer model 230	1				
6625–123–3131	Nelson-Ross Plug-in Spectrum Analyzer model 231	1				

CHAPTER 2

OPERATION

Section I. CONTROLS

2-1. Inspection and Installation

When the plug-in unit is unpacked, inspect it carefully before installing it into the oscilloscope. Look for obvious indications of any physical damage which may have been sustained during shipping. All tubes and crystals should be firmly seated in their respective sockets. Insert the plug-in unit into any Hewlett-Packard model 140A oscilloscope. Turn the knurled lock knob (in the upper right corner of the analyzer) clockwise to secure the unit.

2-2. Initial Adjustments

a. Certain initial adjustments must be performed when installing the plug-in unit for the first time. These initial adjustments must be made so that a true representation of control functions will be possible. Turn the oscilloscope power on, and allow a 10-minute warm up period. Set the controls (figs. 2-1 and 2-2) as follows:

INPUT ATTENUATOR	0 DB
IF GAIN	Fully CCW
SCAN WIDTH-CPS/CM	1K
MANUAL-AUTO SCAN	AUTO SCAN
60 DB LOG-LINEAR	LINEAR
VIDEO FILTER	OUT
FINE TUNING	Centered
V POS	Centered
INTENSITY (on oscilloscope)	Centered
FOCUS (on oscilloscope)	Centered

b. Connect a source of local oscillator power (in model PSA 231 this may be the internal oscillator) to the SIGNAL INPUT connector. For a discussion of the requirements for this source, refer to paragraph 2-3*e*. Using the H POS and WIDTH screwdriver adjustments on the panel, set the trace to occupy the full 10-centimeter width on the crt. Adjust the V POS control to position the trace on the lowest 10-cm line on the graticule. Adjust the FOCUS, INTENSITY, and ASTIGMATISM controls on the oscilloscope to provide a sharp trace of medium intensity. All initial adjustments having been accomplished, the instrument is ready for use.

NOTE

The instrument is designed to present a display which occupies the central area of the crt, 10 centimeters wide by 6 centimeters high. The two areas above and below the central region are not used. A full scale signal is defined as one which produces a 6-centimeter vertical deflection.

2-3. Functions of Controls

Figures 2-1 and 2-2 contain a brief explanation of each control. The following text will present a further explanation of controls and the operational settings used during initial operation. The plug-in spectrum analyzers may be used in any application where the necessity exists to visually observe the frequency distribution of a signal. With this instrument, it is possible to measure the relative amplitudes as well as the absolute values of each of the various components which make up a complex signal. The plug-in spectrum analyzer is designed so that its basic operating characteristics may be adjusted to provide the parameters required for analysis of the desired signal. These parameters are adjusted through the use of the following controls:

a. SCAN WIDTH CPS/CM. This switch selects any one of seven different horizontal scan widths for display on the crt. Scan width is the horizontal frequency scale of the instrument. *For example,* when the SCAN WIDTH selector switch is placed in the 1K position, signals 1 kHz apart will appear at 1-centimeter horizontal intervals on the display. Since the size of the display is 10 centimeters, a total frequency band 10 kHz wide will appear on the screen.

b. Resolution and sweep Speed. Resolution and sweep speed are not manually controlled. These

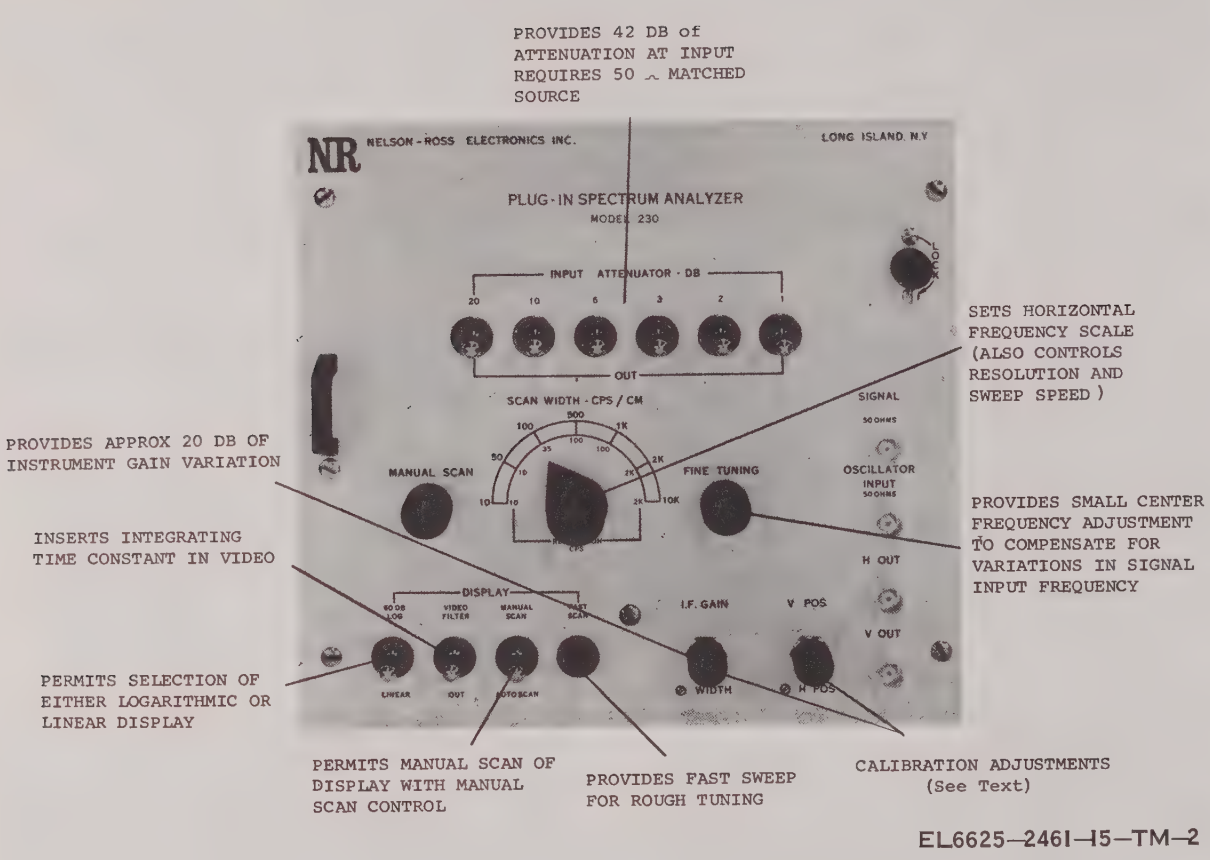
PROVIDES 42 DB of ATTENUATION AT INPUT REQUIRES 50 Ω MATCHED SOURCE
NELSON-ROSS ELECTRONICS INC.
LONG ISLAND, N.Y.
PLUG-IN SPECTRUM ANALYZER
MODEL 230
INPUT ATTENUATOR - DB
OUT
SCAN WIDTH - CPS / CM
SIGNAL
50 OHMS
OSCILLATOR INPUT
MANUAL SCAN
FINE TUNING
H OUT
DISPLAY
I.F. GAIN
V POS
V OUT
WIDTH
H POS
SETS HORIZONTAL FREQUENCY SCALE (ALSO CONTROLS RESOLUTION AND SWEEP SPEED)
PROVIDES APPROX 20 DB OF INSTRUMENT GAIN VARIATION
INSERTS INTEGRATING TIME CONSTANT IN VIDEO
PROVIDES SMALL CENTER FREQUENCY ADJUSTMENT TO COMPENSATE FOR VARIATIONS IN SIGNAL INPUT FREQUENCY
PERMITS SELECTION OF EITHER LOGARITHMIC OR LINEAR DISPLAY
PERMITS MANUAL SCAN OF DISPLAY WITH MANUAL SCAN CONTROL
PROVIDES FAST SWEEP FOR ROUGH TUNING
CALIBRATION ADJUSTMENTS (See Text)
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Figure 2-1. Model PSA 230, controls and functions.

two functions are automatically programed with the functions given below.

(1) *SCAN WIDTH.* This control automatically programs both the resolution and sweep speed to provide a display of constant amplitude. The resolution is adjusted to provide the most suitable value for the horizontal sensitivity selected. (Refer to para 1-4*d*(3) for an explanation of resolution.) The sweep speed is also programed to provide the fastest possible scan without amplitude sensitivity loss.

(2) *60 DB LOG-LINEAR.* The sweep speed is automatically decreased in the LOG position to compensate for increased dynamic range of the display. Resolution is not affected.

(3) *VIDEO FILTER.* The sweep speed is automatically decreased when the VIDEO FILTER is switched in, to maintain compatibility with the reduced video bandwidth. Resolution is not affected.

c. Input Attenuator. The input attenuator is a constant impedance attenuator consisting of six individual steps. It provides 42 db of attenuation in 1-db steps on the PSA 230 and 51 db of attenuation on the PSA 231. The attenuator must be properly matched in order to operate properly. The input impedance of the instrument is 50 ohms, and the characteristic impedance of the attenuator is also 50 ohms. Thus, the attenuator is properly terminated at all times. In order to obtain proper operation of the attenuator, the signal source impedance must also be 50 ohms. While the instrument will operate with a considerable mismatch at the input, the attenuator accuracy and flatness will suffer. If there is any doubt as to the impedance of the source, and the attenuator is to be used, a coaxial pad of 6 db or more should be inserted at the input to insure a good match. Since this attenuator is directly at the input, it may be used for relative amplitude measurements without the introduction of errors due to the analyzer.

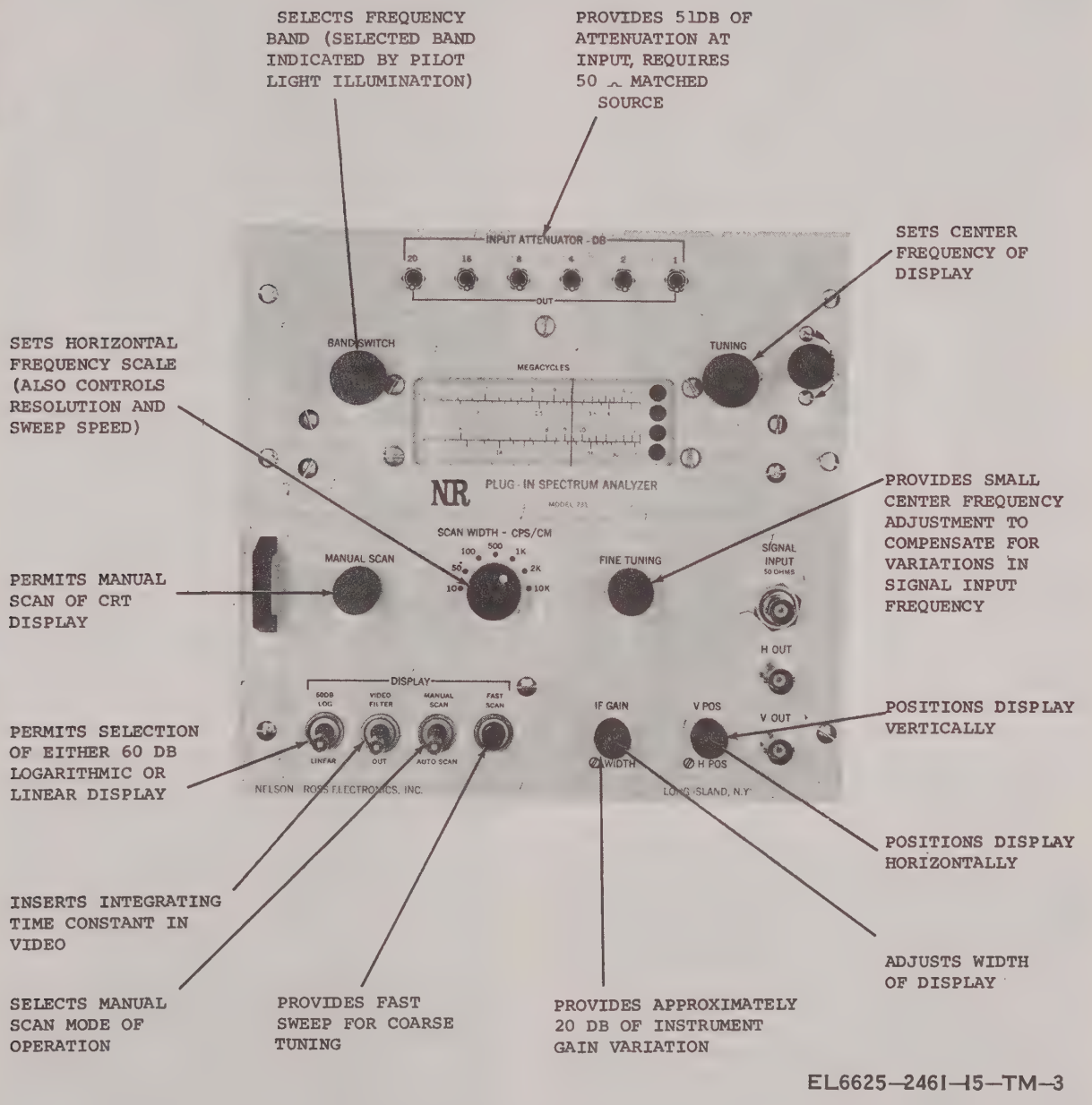


Figure 2-2. Model PSA 231, controls and functions.

d. Display Controls.

(1) *60 DB LOG-LINEAR switch.* This switch controls the type of vertical display produced by the oscilloscope. In the LINEAR position, deflection on the oscilloscope screen will be directly proportional to the input signal amplitude, while in the LOG position the oscilloscope deflection will be proportional to the logarithm of the input signal. This provides a display calibrated directly in decibels. Since the instrument has a dynamic range of 60 db, the LOG display provides a 60-db characteristic. A signal 60 db down from full scale produces a deflection of approximately 1/2 to 1 centimeter. In the first 40 db of the display, each centimeter corresponds to 10 db. A signal 50 db down deflects the display 1 1/2

centimeters. It is thus possible to observe all components of a signal over a 60-db range. Since the dynamic range of the display is greatly increased in LOG, the sweep speed of the analyzer is automatically reduced to provide a better display.

NOTE

To ensure that the instrument is not producing any spurious intermodulation products, the signal level at the input must be controlled so that in log display mode, the largest component of the signal does not exceed 6 centimeters or in LINEAR display mode, with the IF GAIN ccw and the INPUT ATTENUATOR at 42 db (maximum attenuation), the largest component of the signal does not exceed full screen. The IF GAIN and INPUT ATTENUATOR may then be set anywhere in their ranges. If these instructions are followed, the instrument will not contribute any intermodulation products (or other types of distortion products) greater than specified for the instrument.

(2) *VIDEO FILTER switch.* This switch inserts an integration time constant in the video amplifier of the instrument. This provides suppression of beat notes that occur when signals with close components are being observed. It is also useful in filtering out noise. Since the filter reduces the frequency response of the vertical amplifier, the sweep speed at the analyzer is automatically reduced when it is in operation.

(3) *MANUAL–AUTO SCAN switch.* This switch provides two methods of operation. In AUTO SCAN the instrument automatically scans the crt display at an internally selected optimum sweep speed. In MANUAL SCAN the crt display is scanned by rotating the MANUAL SCAN knob on the panel. This permits point-by-point measurements to be made.

(4) *FAST SCAN button.* This button, when pressed, overcomes the internal sweep speed programer, providing a fast sweep for tuning and searching. When this button is pressed the sweep speed will be greater than optimum, causing the display to ring. However, it is useful for locating signals, which may then be observed at programed sweep speeds.

(5) *IF GAIN.* This potentiometer provides a minimum of 20 db of gain variation in the IF system of the instrument.

(6) *FINE TUNING.* This control varies the center frequency of the instrument ±10kHz to provide correction for small frequency changes in the input. When tuning the instrument by means of the TUNING control, the FINE TUNING control should be centered, so that it may later be used to compensate in either direction.

e. Tuning and Band Switch.

(1) *PSA 230 (external local oscillator).*

(*a*) Although there are no TUNING and BAND SWITCH controls on the PSA 230, there will be equivalent controls on the external local oscillator, therefore, a discussion of the tuning action provided by these controls is pertinent. The first IF of the analyzer is 500 kHz. The instrument input circuit is a mixer, which is designed to add and subtract the input and local oscillator input signals. Combinations of signals producing a difference frequency of 500 kHz will result in a display on the crt screen. The local oscillator input circuit is unaffected by input levels, provided that the required input is supplied. The signal input circuit is linear, so that the spectrum of the signal applied to the SIGNAL INPUT connector will be displayed on the screen.

(*b*) For each input frequency, there are two primary local oscillator frequencies that will produce a display: 500 kHz above and 500 kHz below the input signal frequency. Either one may be utilized, with the same results. Other, secondary, frequencies may also produce a display. Any oscillator input which has a harmonic differing from the input by ±500 kHz will produce a display. Similarly, signals having harmonics differing from harmonics of the local oscillator by ±500 kHz will produce a display. All of these displays will be true spectra of the input, differing from one another only by the instrument gain and sensitivity, and the "sense" of the horizontal scan.

(*c*) The sense of the horizontal scan depends upon the mixing process selected. The crt spot always travels from left to right on the display. A 500-kHz signal at the input will appear at the center of the screen, as will any signal producing 500 kHz in combination with the local oscillator. Frequencies lower than 500 kHz will appear to the left of (and frequencies higher than 500 kHz to the right of) the center of the display. If the display results from a local oscillator frequency above the input signal there will be an inversion, with higher frequencies on the left and lower frequencies on the right. If the display results from the use of a local oscillator frequency below the input, there will be no inversion.

(*d*) It can be seen from the above that many displays will appear at different points on the local oscillator tuning dial. The desired display is called the signal display. The second pri-

mary display is commonly called the image, while all others are classified as spurious responses. These usually occur as signal and image pairs in the same manner as the primary displays. There are occasions when it may be desirable to utilize one of the spurious responses to generate the display. This usually occurs when a signal much higher than the available local oscillator is to be observed. The local oscillator is tuned to a subharmonic (1/2, 1/3, 1/4, etc.) of the actual oscillator frequency required and somewhat more power provided (10 to 20 db). The mixer will generate the required harmonic, resulting in a display of the signal as required. This is commonly called harmonic mixing. A loss of sensitivity always accompanies harmonic mixing. The resulting spectrum, however, will be correct.

(*e*) In order to distinguish between upper and lower sidebands, or to calculate the exact frequency of the signal, the exact relationship of signal and local oscillator must be determined. Given below is a set of general rules on how to determine this relationship.

1. To determine whether the oscillator frequency is above the signal or below, center the signal on the display, and then increase the oscillator frequency slightly. If the signal moves to the right the oscillator frequency is above the signal; if it moves to the left the oscillator frequency is below the signal.

2. To determine whether you are looking at a harmonic of the signal, tune to integral subharmonic input frequencies and look for the same display. They will usually appear with much greater amplitude.

3. To determine whether you are using the oscillator directly or on a harmonic, increase the oscillator frequency by integral factors and look for the same display. The highest oscillator frequency which will produce a display is the one causing the primary displays.

(2) *PSA 231 (internal local oscillator).* The BAND SWITCH and TUNING controls are used in exactly the same manner as the controls on the external local oscillator would be used ((1) above) with one exception: the frequency (megacyles) dial is calibrated directly in the input signal frequency rather than the oscillator frequency. The oscillator frequency is always 500 kHz higher than the indicated frequency. To determine whether the signal or image is displayed, refer to (1)(*b*) above.

Section II. APPLICATIONS

2–4. General

The PSA 230 and PSA 231 plug-in units are capable of performing in many applications. A few of the possible instrument applications are given below.

2–5. Distortion Analysis

The percentage of distortion products of both amplifiers and oscillators may be determined by using an instrument operating within the desired range. Examination of the input signal is made first. Quality and harmonic content are observed. The output of the unit under test is then observed. Performance is determined by subtracting the input harmonic content from the output harmonic content.

2–6. Intermodulation Distortion Percentage

Intermodulation distortion percentage is measured by using a two-tone oscillator to drive the unit under test. In addition it is possible to use two oscillators which are fed into a resistive mixer coupled to the input of the unit. The sum and difference signals in the output are then measured in relation to the fundamental outputs.

2–7. Typical Displays

Figure 2–3 illustrates oscilloscope presentations which are obtained in typical spectrum analyzer applications. A brief technical description follows for each presentation shown.

a. The dynamic range and resolution of the instrument is shown in A, figure 2–3. The display is logarithmic, at 50 Hz per centimeter (10 Hz resolution) scan width. The input is a 5-MHz cw signal, with modulation producing two sidebands at ±120 Hz, 60 down. Note the freedom from spurious responses and hum sidebands.

b. Part B, figure 2–3 is an analysis of a carrier generator with 120 cycle hum component 46 db down. The display is linear at a 50-Hz per centimeter (10 Hz resolution) scan width. Smaller hum components at −60 db + 180 Hz and −240 Hz are also visible.

c. Part C, figure 2–3 illustrates a 7.5-MHz single sideband transmission taken directly off the

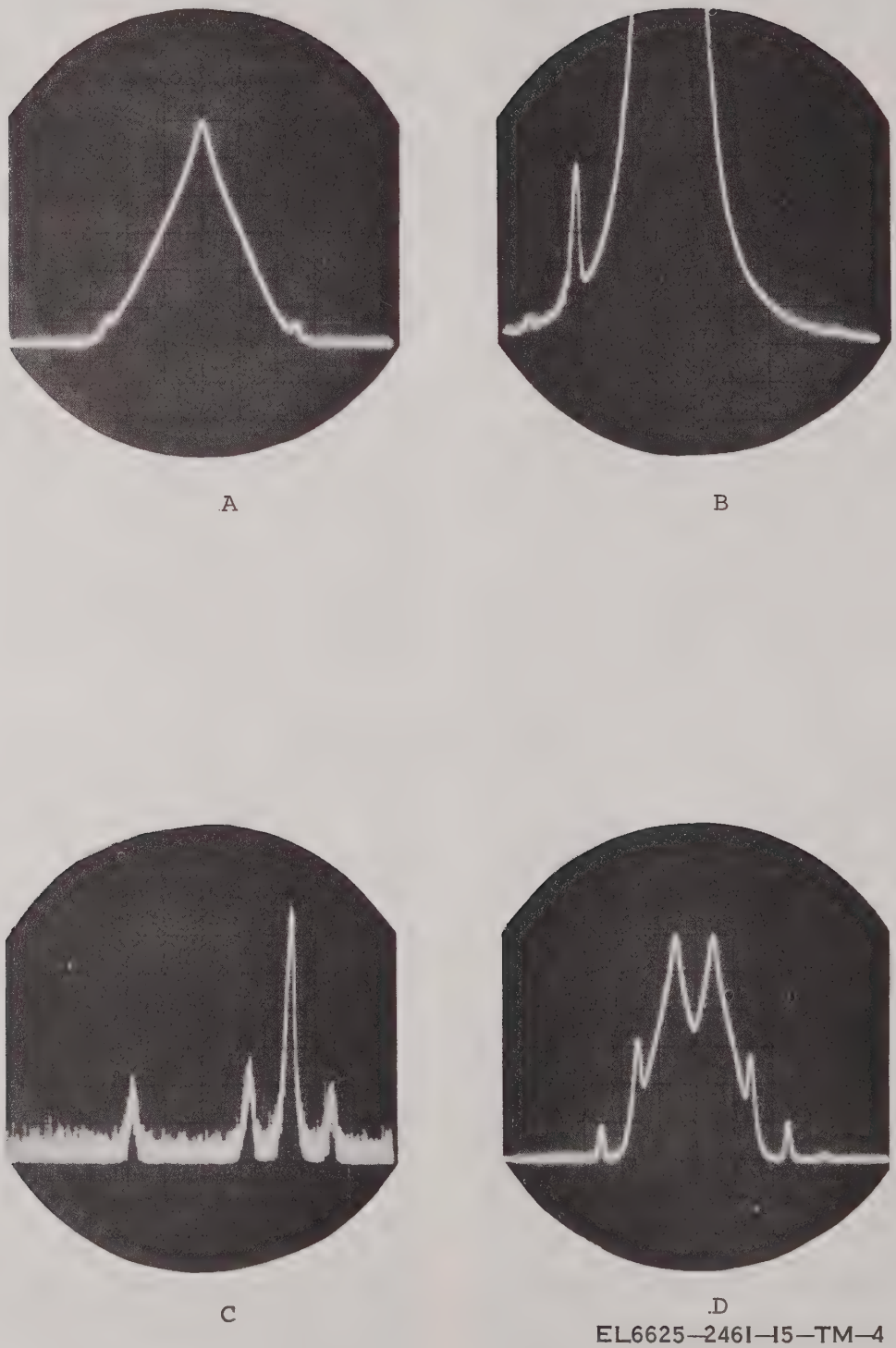


Figure 2–3. Typical displays.

air at approximately −85 dbm peak sideband power. A 2200-Hz tone was being transmitted, 30% modulated at 520 Hz. Note the carrier at the left. Carrier suppression is apparently only 10 db. However, it was determined that the 2200-Hz tone was being transmitted at −20 db relative to rated peak sideband power, so the actual carrier suppression is 30 db.

d. The display shown in D, figure 2–3 results from two-tone intermodulation (IM) test being made on a linear power amplifier. The signal was obtained by loosely coupling to the dummy load. The input was two equal tones 1 kHz apart. IM products are clearly visible at −30 db and −55 db.

CHAPTER 3

CIRCUIT DESCRIPTION

3-1. General

The circuit description presented in this chapter applies to both the PSA 230 and PSA 231. These analyzers are identical except for the internal local oscillator, which is provided in the PSA 231 only, and slight differences in panel layout.

3-2. Block Diagram Description

a. Figure 3-1 is a block diagram representation of the circuitry in the plug-in spectrum analyzer. The input signal first passes through the input attenuator where the desired level is adjusted. The attenuated input signal is then routed through the balanced mixer. The input signal is mixed with the local oscillator signal either internally or externally generated, in the balanced mixer. Oscillator spurious products are suppressed, while the sum and the difference frequency signals are enhanced. The output of the mixer is amplified in the low-noise, wide band 500-kHz IF amplifier, and fed via the IF GAIN control to the second mixer and oscillator, where it is heterodyned with the swept local oscillator (550 to 650 kHz). The resultant difference signal then passes through the 100-kHz crystal filter. The frequency response of this filter is varied with the SCAN WIDTH control in order to provide the required degree of signal resolution on the screen of the oscilloscope. The signal output from the filter drives the IF amplifier. Most of the instrument gain is provided by the amplifier. The IF amplifier is tuned to the 100-kHz difference frequency of the mixer output. The output of the IF amplifier is detected and routed two ways.

b. One routing passes to the vertical amplifier. The other routing provides a feedback signal which is used to generate a log function. When the VIDEO FILTER switch is in the LINEAR position, this feedback signal is not utilized.

c. The sawtooth output of the internal sweep generator drives both a reactance tube and the horizontal amplifier in the oscilloscope. The sweep speed is automatically varied by the SCAN WIDTH switch. The reactance tube sweeps the local oscillator in synchronism with the oscilloscope trace. Reactance tube drive is furnished through the scan control circuits, operated by the SCAN WIDTH switch.

3-3. Detailed Circuit Description (figs. 4-8 and 4-9)

a. Input Attenuator. The input attenuator (fig. 4-7) consists of 6 toggle switch operated pi-section attenuators. With the switches in the OUT position, the attenuator is removed from the circuit. In the IN position, a 50-ohm pi-section having the required loss is inserted. In this manner, the circuit impedance is held constant.

b. Phase Inverter. The phase inverter converts the single-ended oscillator input into a push-pull signal for the balanced mixer. It consists of a pentode amplifier with equal plate and cathode loads (furnished by adjustment of the MIXER BAL potentiometer R6).

c. Balanced Mixer. The balanced mixer consists of diodes CR1 and CR2, coupled to the IF amplifier by means of transformer L1. The push-pull oscillator input cancels in the output, while the signal and the mixing products appear on the primary of L1. The secondary of L1 provides an impedance stepup to match the grid of IF amplifier V2.

d. 500-KHz IF Amplifier. This amplifier, consisting of tubes V2 and V3, determines the noise figure of the instrument (in conjunction with the mixer) and provides sufficient gain to overcome the noise of the second mixer. It is a tuned doublet, with 3-db points ±50 kHz from the center frequency of 500 kHz. The gain of V2 is controlled by internal adjustment potentiometers R57 (2 KC GAIN), R58 (100 CPS GAIN) and R59 (35 CPS GAIN) via the SCAN WIDTH switch to provide constant instrument gain despite variations of the crystal filter loss with resolution changes.

e. Second Mixer and Oscillator.

(1) The second mixer is a pentagrid converter, driven from a triode oscillator. Dual tri-

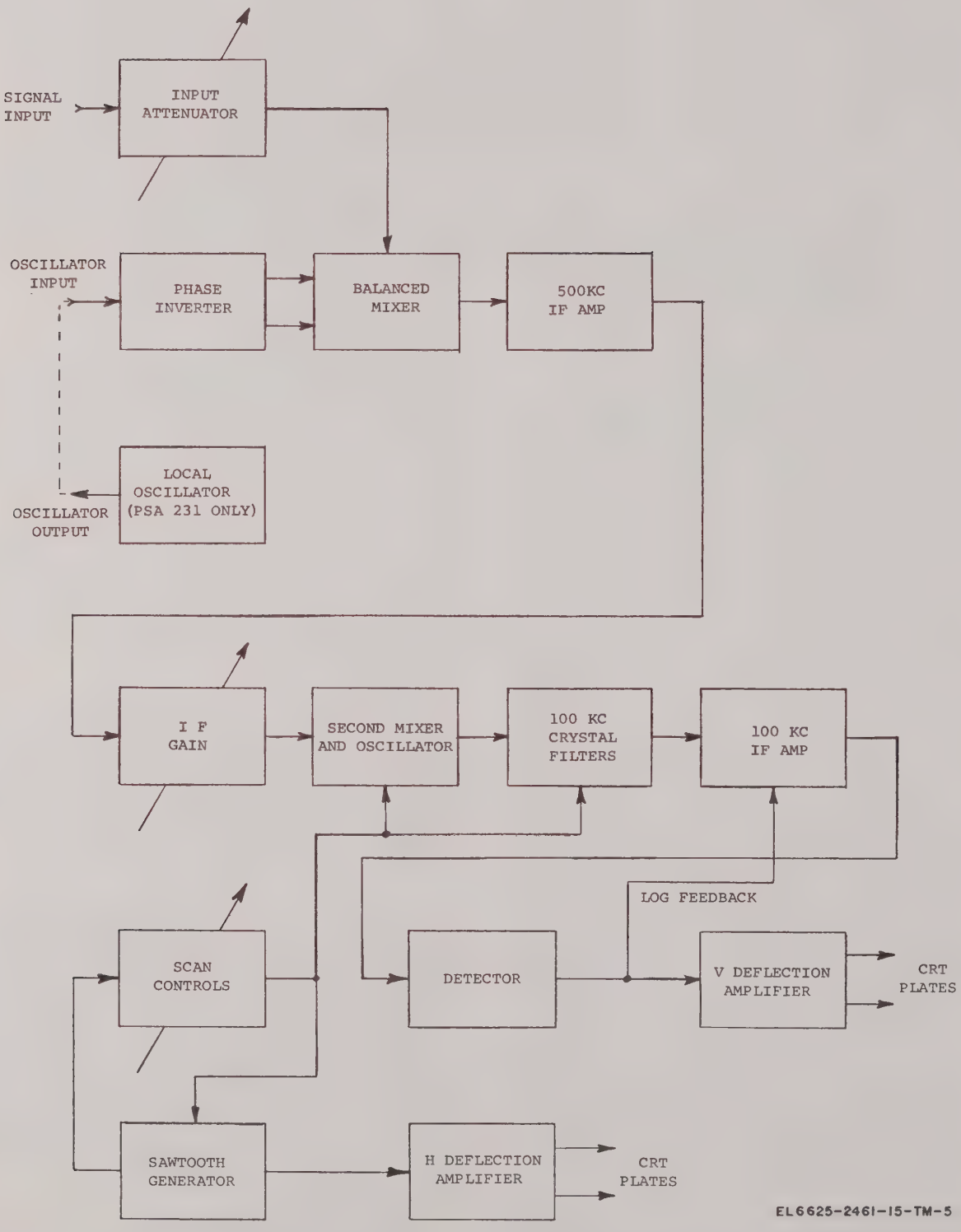


Figure 3-1. Plug-in spectrum analyzers, block diagram.

ode V7 serves as both a Hartley oscillator and a reactance tube. Coil Z4 provides reasonant tank circuit inductance. The reactance circuit is conventional in design. Capacitor C41 provides only a portion of the resonant capacitance of the tank circuit. Additional capacitance is inserted across the coil by the grid plate capacitance of the reactance tube section of V7.

(2) This capacitance is multiplied by the gain of the stage. The capacity seen by the oscillator tank is therefore proportional to the transconductance (GM) of the tube. When the plate current on the tube is varied (by changes in the sawtooth drive present on the grid) the GM of the tube changes. As a result of this change in GM, the local oscillator frequency changes. Adjustment of RT ADJUST potentiometer R49 will determine the oscillator sweep frequency range with the full sawtooth input.

f. Crystal Filter.

(1) Tubes V5 and V6 are utilized to drive the two sections of the crystal filter network. Resolution is determined by the combined bandwidth of the two crystal filter sections. Bandwidth of each filter section is determined by shunting the output of each section with a resistance.

(2) By changing the value of resistance the effective "Q" is changed. As a result, the filter bandwidth around the IF is also varied. The bandwidth determines the resolution of the plug-in unit. The SCAN WIDTH switch SIA and SIE simultaneously vary the "Q" of both sections. Capacity across each of the crystal holders is neutralized by adjustment of trimmer capacitors C26 and C29.

g. IF Amplifier. The IF amplifier is composed of two double-tuned stages consisting of V8 and V9. The majority of the plug-in unit gain is provided by this circuit. With the exception of the log feedback, the amplifier circuitry is quite conventional. The output of V9 is a dc voltage which appears only when an IF signal is present. The output of V9 is detected by diode CR4. The detected signal is then fed to the oscilloscope vertical amplifier through an integrating network consisting of resistor R71, the VIDEO FILTER switch, and capacitors C52 and C53 (PSA 230), or R63, C44, and C46 (PSA 231).

h. Log Circuitry.

(1) Log scale generation is accomplished by using a feedback signal to control the gain of IF amplifier V8. The IF signal from the output of V9 is detected and the resultant voltage is fed back to the grid of V8 as a bias voltage.

(2) Tube V8 has a cutoff characteristic especially applicable to this circuit. As the input increases, the detected bias also increases. The result is a decrease in the gain of the stage. The pentode characteristics of V8 determine the logarithmic pattern of the oscilloscope display. The decibel range is controlled by varying the setting of the diode output divider R69 (DB RANGE). Any change in this screen voltage has a direct effect on the operating point and the slope characteristics of the tube. Adjustment of potentiometer R61 (DB SHAPE) provides the desired log shape.

i. Sweep Generator. Tubes V11 and V12 function as a free running sawtooth generator. The negative feedback between plate and grid of V11 (via cathode follower V12 and RC network C56 and a resistor selected by SID from the group of R84 through R91 and PSA 230 and C49 and R87 through R93 on the PSA 231) determines the sweep time, while the positive feedback between the plate and screen of V11 generates the retrace. The scan time is a function of the RC time constant and the applied voltage. These parameters are automatically controlled by the SCAN WIDTH switch, the VIDEO FILTER switch and the 60 DB LOG–LINEAR switch to provide optimum scan time for all control settings.

j. Deflection Amplifiers. Tubes V10 and V13 function as vertical and horizontal deflection amplifiers, respectively. Single-ended signals present on one grid (pin 2) are converted into push-pull signals at the plates. The dc voltage at the plates is varied by controls R83 and R81 to provide positioning of the crt trace.

k. Internal Local Oscillator. Model PSA 231 is provided with its own local oscillator, which provides the required minimum signal output at J206. V201 acts as both the Hartley oscillator and the isolating cathode follower. The bandswitch selects any one of four resonant tank circuits, providing frequencies from 1.1 to 36.5 megacycles. The low output impedance is provided by the cathode follower.

l. Power and Bias Circuitry. All operating voltages required for plug-in unit operation are obtained from the oscilloscope's internal power supplies. In order to insure a high degree of regulation over a wide range of operating conditions, all unused supplied (within the oscilloscope) are loaded to their minimum requirements.

CHAPTER 4

MAINTENANCE

4–1. General

This chapter contains the instructions required for maintenance of the Nelson-Ross Plug-In Spectrum Analyzers, models 230 and 231 (PSA 230 and PSA 231). Included are preventive maintenance, troubleshooting, and alignment procedures.

4–2. Preventive Maintenance

Visually inspect the unit for damaged connectors or components each time it is plugged into an oscilloscope. Check for frayed insulation and for evidence of components overheating. During normal operation, check for proper mechanical action of knobs, dials, and switches.

4–3. Troubleshooting

a. Incorrect control settings can result in displays that are indicative of equipment malfunctions. When a fault indication is observed, first check for proper control settings. If a fault exists, it must be isolated to the oscilloscope main frame or the plug-in unit.

b. The trouble can be isolated to either the oscilloscope main frame or the plug-in unit by one of two methods: replacement of the plug-in unit with a spare unit, or verification of input signals, supply voltages, and analysis of the screen display.

CAUTION

Before plugging in the spare unit, inspect the original unit for charred components or burned wiring. Such damage could be the result of excessive oscilloscope supply voltages. If there is evidence of overheating, make complete voltage checks before installing a spare, otherwise the spare unit may be damaged.

c. If, after a spare unit (known to be functioning properly) is substituted, the system does not work properly, the fault is in the oscilloscope. Refer to the oscilloscope instruction manual for correct maintenance procedures. If a spare unit is not available for substitution, further testing must be performed. If a plug-in extension cable is supplied with the oscilloscope, it may be used to facilitate the required testing. Otherwise, the top and bottom covers may be removed from the oscilloscope, and the unit placed on its side. First, check all voltages supplied by the oscilloscope to the plug-in unit. If the voltages measure incorrectly, remove the plug-in spectrum analyzer and recheck the voltages. If the voltages check correctly with the spectrum analyzer removed, the trouble is probably in the plug-in unit.

d. The voltages indicated on the schematic diagrams (figs. 4–8 and 4–9) and the tube voltage charts (para 4–4) are nominal, with the exception of the supply voltages, which are of close tolerance. The nominal voltages may vary considerably in each instrument.

e. When it has been established that the trouble is in the plug-in unit, check the unit for burned or broken wires, defective switches, overheated or discolored components, and loose or improperly seated tubes and crystals. If a burned or discolored component is discovered, locate and correct the direct cause of the trouble before replacing the component.

f. One very common source of trouble may be attributed to faulty vacuum tubes. If a visual check fails to reveal the cause of the trouble, it is recommended that all tubes be checked by the substitution method. Tube checks made by the tube tester method are not to be relied upon because of the wide tube operating parameters. Tubes which are found to be operating correctly should be returned to their original sockets to avoid recalibration due to variable tube characteristics. If, after visual examination and tube substitution, the trouble still is not located, the spectrum analyzer circuitry should be checked by making careful voltage and resistance measurements at the points indicated on the schematic diagrams (figs.

4–8 and 4–9) and the tube voltage charts (para 4–4).

NOTE

If crystal Y1 or Y2, or a resolution resistor (R39, R41, R42, R44, R46 and R47 in the PSA 230; R32, R33, R34, R42, R43 and R44 in the PSA 231) must be replaced, it is necessary that the entire set (the two crystals and six resistors) be replaced. Use only the components contained in the filter-crystal repair kit. (Refer to app. C.)

4–4. Tube Voltage Charts

The voltages given in the following charts should be used as a guide to normal performance. These voltages are typical and may vary slightly.

a. PSA 230. The readings listed in the following chart were obtained with the control settings as given below, using a 20,000-ohms-per-volt voltmeter.

SCAN WIDTH–CPS/CM	500
FINE TUNING	Center of range
INPUT ATTENUATOR	Maximum attenuation
V POS	Center scan on crt
H POS	Center scan on crt
IF GAIN	Maximum gain
WIDTH	One-half maximum width
DISPLAY	LINEAR, VIDEO FILTER OUT, AUTO SCAN

Tube	Pin Numbers								
	1	2	3	4	5	6	7	8	9
V1 12AU6	+100V	+100V	0	−12V	+215V	+235V	+100V		
V2 12AU6	0	0	0	−12V	+160V	+160V	+1.85V		
V3 12AU6	0	0	0	−12V	+100V	+100V	+2		
V4 12BE6	−4.2	+1.6	0	−12V	+95V	+100V	0		
V5 12AT7	+170V	+5.6	+11	0	−12V	+170V	+5.6V	+11	NC
V6 6BH6	+5	+10	6.3 VAC	6.3 VAC	+135V	+140	+10		
V7 6201	+175V	0	+3.6	0	−12V	+200	−6.4	+.85	NC
V8 6AU6	0	0	6.3 VAC	6.3 VAC	+100	+30	+.65		
V9 6AU6	0	0	6.3 VAC	6.3 VAC	+185	+100	+1.3		
V10 12AT7	+175	0	+3.4	6.3 VAC	6.3 VAC	+175	−.25	+3.4	6.3 VAC
V11 6AS6	−5	0	6.3 VAC	6.3 VAC	+150	+100	−.10		
V12 12AT7	+250	+150	+160	6.3 VAC	6.3 VAC	+250	+40	+40	6.3 VAC
V13 12AT7	+175	+.5	3.6	6.3 VAC	6.3 VAC	+175	−1.0	+3.6	6.3 VAC

b. PSA 231. The readings listed in the following chart were obtained with the plug-in control settings as given below, using a 20,000-ohm-per-volt voltmeter.

SCAN WIDTH–CPS/CM	10K
FINE TUNING	Center of range
INPUT ATTENUATOR	OUT
V POS	Centered
H POS	Centered
IF GAIN	Centered
WIDTH	Centered
60 DB LOG–LINEAR	LINEAR
VIDEO FILTER	OUT
MANUAL–AUTO SCAN	MANUAL SCAN
FAST SCAN	Out
MANUAL SCAN	Centered
BAND SWITCH	Band 1 (ccw)
TUNING	Centered

Tube	Pin Numbers								
	1	2	3	4	5	6	7	8	9
V1 12AU6	98V	100V	0V	−12V	205V	225V	100V		
V2 12AU6	0V	0V	0V	−12V	160V	160V	1.8V		
V3 12AU6	0V	0V	0V	−12V	95V	95V	1.0V		
V4 12BE6	−3.4V	1.5V	0V	−12V	91V	96V	0V		
V5 12AT7	165V	6V	11V	0V	−12V	165V	6V	11V	
V6 6 BH6	5.5V	9.3V	6.3V (AC)	0V	125V	132V	9.3V		
V7 6201	175V	0V	3.2V	0V	−12V	200V	−0.55V	0.74V	0V
V8 6AU6	0V	0V	6.3V (AC)	0V	19V	4.4V	0.58V		
V9 6AU6	0V	0V	6.3V (AC)	0V	220V	19V	0.38V		
V10 12AT7	175V	−0.25V	5V	6.3V (AC)	6.3V (AC)	175V	1.4V	5V	0V
V11 6AS6	−1.2V	0V	0V	6.3V (AC)	3.3V	97V	−0.15V		
V12 12AT7	250V	3.3V	8V	6.3V (AC)	6.3V (AC)	250V	−12V	−8.3V	0V
V13 12AT7	175V	−0.34V	5V	6.3V (AC)	6.3V (AC)	160V	1.4V	5V	0V
V201 6201	100V	−2.5V	0V	−12V	0V	230V	99V	100V	−6V

4-5. Alignment

The following instructions provide the complete procedures for aligning the PSA 230 and PSA 231. These instructions, when followed in the proper sequence, also furnish a method of trouble isolation and are effective as a troubleshooting procedure. Alignment controls are illustrated in figures 4-1 through 4-3.

a. Test Equipment Required. The following equipment (or equivalent) is required for alignment of the PSA 230 and 231:

(1) Oscilloscope, Hewlett-Packard 140A (upper and lower covers and plug-in partition removed).

(2) Oscilloscope, Hewlett-Packard 140A with 1400A or 1401A vertical plug-in and 1420A time base plug-in.

(3) Signal generator, Hewlett-Packard 606A.

(4) Audio oscillator, Hewlett-Packard 200AB.

(5) Volt-ohm-milliammeter, Simpson 260.

(6) Assorted cables, clip leads and connectors, as required.

b. Preliminary Control Settings.

(1) Insert the plug-in spectrum analyzer in the Hewlett-Packard 140/141A oscilloscope frame

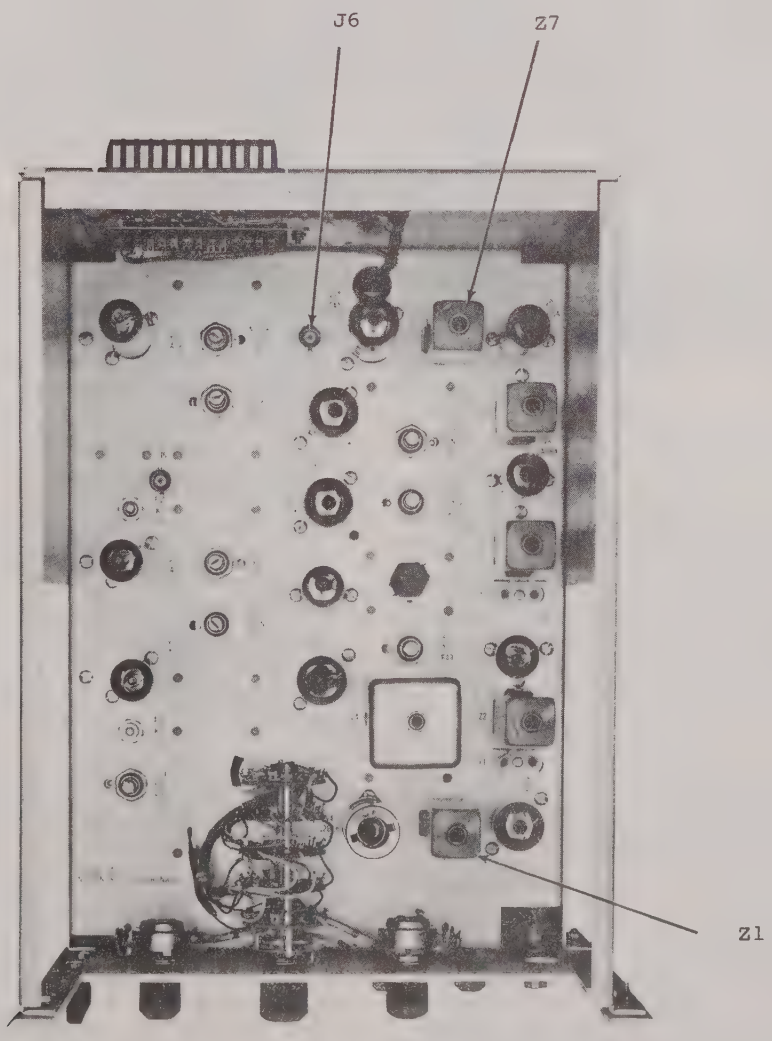
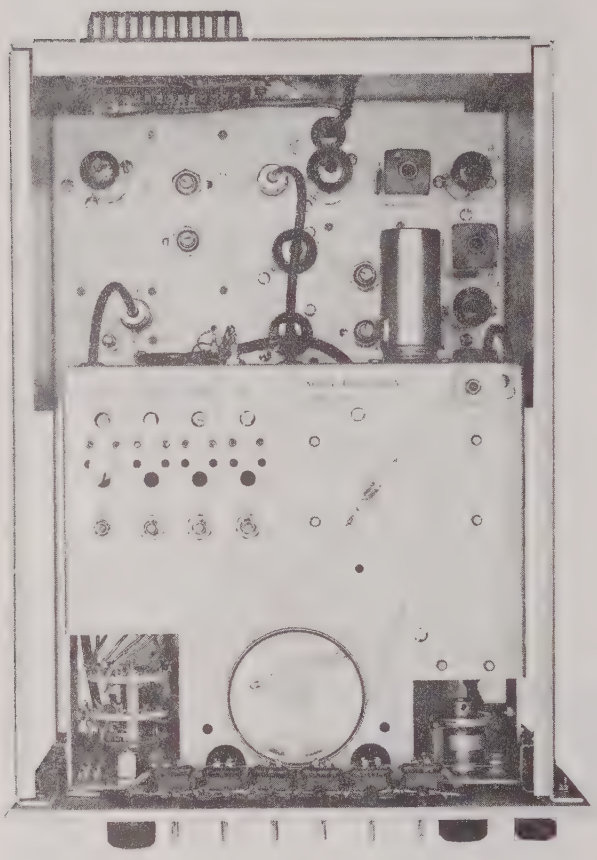


Figure 4-1. Alignment controls, top chassis.



EL6625—2461—15—TM—7

Figure 4-2. Alignment controls, bottom chassis.

and lock. Connect all instruments to the power-line and warmup for 10 minutes.

(2) For convenience, lay oscilloscope containing analyzer on its side, crt end down. Both sides of analyzer may now be reached for adjustments.

(3) Set analyzer and scope controls as follows:

NOTE

These control settings are to be used for all tests unless otherwise stated.

IF GAIN	Fully CCW
MANUAL–AUTO SCAN	AUTO
60DB LOG–LINEAR	LINEAR
VIDEO FILTER	OUT
V POS	Centered
WIDTH	Centered
H POS	Centered
FINE TUNING	Centered
INPUT ATTENUATOR	OUT
SCAN WIDTH–CPS/CM	10K
BAND SWITCH (PSA 231 only)	Fully CW
TUNING (PSA 231 only)	Centered
MANUAL SCAN	Centered
FOCUS	Centered
INTENSITY	Centered

(4) Adjust the WIDTH and H POS front panel screwdriver adjustments to obtain a 10-centimeter centered trace.

(5) Adjust the V POS front panel control to place the trace on the lowest 10-centimeter horizontal line on the graticule.

c. Sawtooth Adjustment (Dispersion Balance).

(1) Connect a Hewlett-Packard 140A oscilloscope with a 1400A or 1401A vertical plug-in and a 1420A time base plug-in to the H OUT jack of the analyzer and observe a 1-volt peak-to-peak (nominal) sawtooth. With the oscilloscope dc-coupled, carefully adjust DISP BAL potentiometer R96 (top chassis) to obtain equal positive and negative excursions around ground. Disconnect the oscilloscope.

(2) Connect a Hewlett-Packard 606A signal generator to the SIGNAL INPUT connector on the panel, using a 50-ohm coaxial BNC to BNC cable. Set the signal generator to 500 kHz at about 10 millivolts output. Connect the oscilloscope to the V OUT jack of the analyzer and observe a 2-volt peak-to-peak output (nominal) when the signal amplitude is full scale (6 cm) deflection. The IF GAIN control must be adjusted to provide this deflection.

d. Dispersiion Set Alignment.

(1) Set the controls on the analyzer as follows:

INPUT ATTENUATOR	OUT
BAND SWITCH (PSA 231 only).	Band 3
TUNING (PSA 231 only)	Approximately band center
FINE TUNING	Centered
VIDEO FILTER	OUT
60DB LOG–LINEAR	LINEAR
IF GAIN	Centered
SCAN WIDTH–CPS/CM.	1K

(2) Apply a 500-kHz signal from the signal generator to the SIGNAL INPUT connector of analyzer. Using center frequency adjustment C41, center the 500-kHz signal on the screen.

(3) With the 500-kHz signal centered, apply 5-kHz from a Hewlett-Packard 200AB audio os-

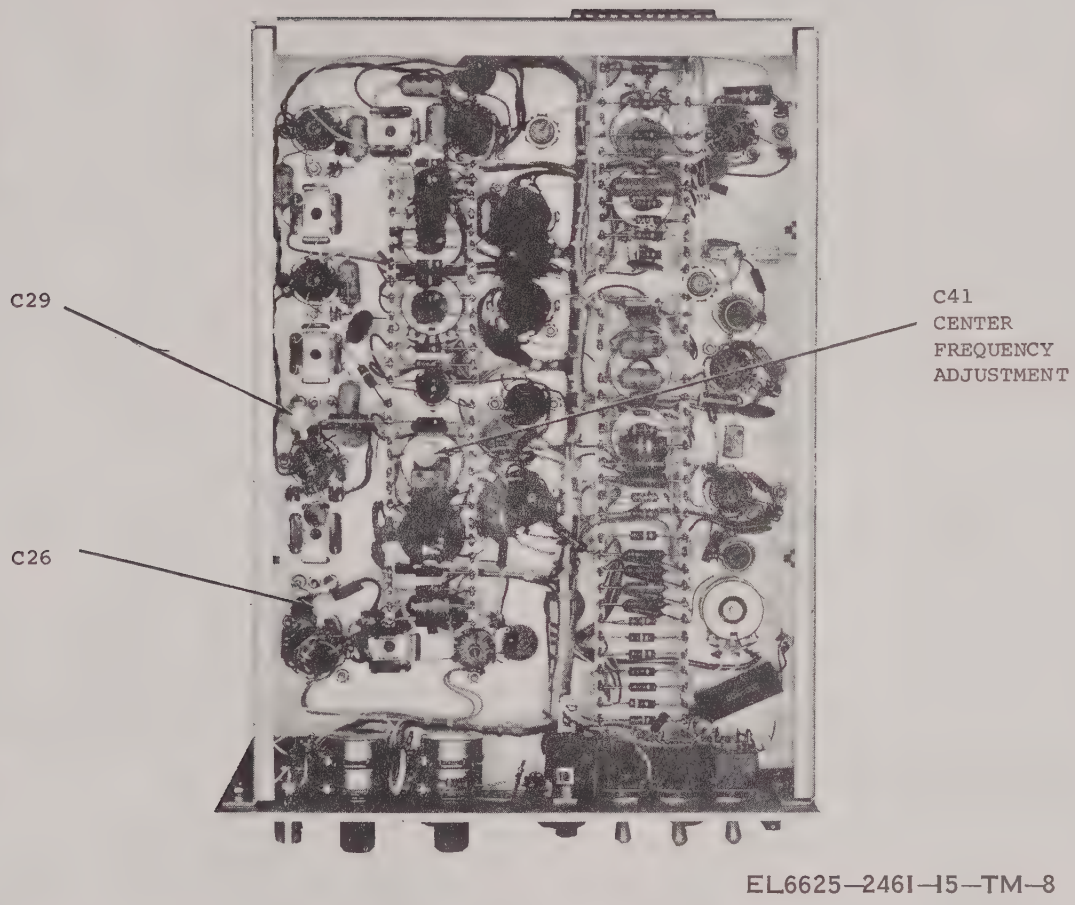


Figure 4–3. Internal local oscillator adjustment.

cillator to the signal generator to provide 20% modulation. (SCAN WIDTH–CPS/CM switch *must* be in 1K position.) Using RT ADJ potentiometer R49, adjust the 5-kHz sideband modulation for full screen (10 cm) deflection. It may be necessary to re-center the signal on the screen. This is accomplished by adjustment of center frequency adjustment C41. Since there is interaction between R49 and C41 small adjustments are suggested on each control until the correct display is achieved (fig. 4–4).

(4) When steps (1) through (3) above have been performed, all SCAN WIDTH positions are set. Check other positions for 10% accuracy in a similar manner.

(5) Remove modulation.

e. Crystal Filter Alignment.

(1) With a 500-kHz signal applied to the SIGNAL INPUT connector of the analyzer and SCAN WIDTH–CPS/CM switch at 1K position, remove crystal Y1 from its socket. (Adjust signal amplitude to keep *peak* of signal visible.) Tune signal-slug transformer Z2 for the broadest pass band. Do not tune for maximum signal, but rather for a minimum point at which the signal is widest and the shape of the pass band is smooth and even. Replace Y1.

(2) Remove Y2 from its socket. Tune Z3 (bottom slug only) transformer for broadest band pass. (Do not tune for maximum signal.) Replace Y2.

(3) Tune Z2 and Z3 (bottom slug) alternately for broadest band pass.

(4) Switch 60 DB LOG–LINEAR switch to 60 DB LOG. Increase signal to full scale. (This expands the skirts of the signal and will give a clearer picture of the skirt leakage, which shows up as a raised baseline on either side of the signal.) If skirt leakage is visible adjust C26 and

C29 to minimize leakage and obtain the best symmetrical band pass characteristics.

(5) Switch the 60 DB LOG–LINEAR switch to LINEAR and retune Z2 and Z3 for maximum flatness.

f. Resolution Calibration. The plug-in analyzers are shipped from the factory with correct resolution components already selected and mounted (R32, R33, R34, R42, R43, R44 in the PSA 231 and R39, R41, R42, R44, R46 and R47 in the PSA 230). These resistors do not normally require any service. If a crystal (Y1 or Y2) or any of the resolution resistors must be replaced, the entire set (the two crystals and all six resistors) must be replaced, using the components contained in the filter-crystal repair kit (app. C).

g. IF Alignment.

(1) With a 500-kHz signal applied to the SIGNAL INPUT connector, set the controls as follows:

SCAN WIDTH–CPS/CM	1K
INPUT ATTENUATOR	OUT
DISPLAY	LINEAR

(2) Set the IF GAIN as required to provide a full screen signal.

(3) Tune Z1, Z6 and Z7 top and botton slugs for maximum signal output. Keep level of the signal visible using the IF GAIN control.

h. Resolution Gain Adjustments.

(1) Turn SCAN WIDTH–CPS/CM switch to 10. Apply a 500-kHz signal to the SIGNAL INPUT connector and adjust the 500-kHz signal for full scale deflection (6 cm).

(2) Using this signal amplitude as a reference, switch the SCAN WIDTH–CPS/CM to 100. Using R59, adjust signal amplitude for full scale deflection (6 cm).

(3) Turn SCAN WIDTH–CPS/CM to 1K. Using R58, adjust the signal for full scale deflection (6 cm).

(4) Turn SCAN WIDTH–CPS/CM to 2K. Using R57, adjust the signal for full scale deflection (6 cm). In all SCAN WIDTH position, the signal should have the same amplitude plus or minus 1 cm of amplitude.

i. Preliminary Sensitivity Check.

(1) Turn SCAN WIDTH–CPS/CM switch to 10K. Turn IF GAIN control fully clockwise.

(2) With signal generator attenuator, adjust the signal until it is twice the height of the

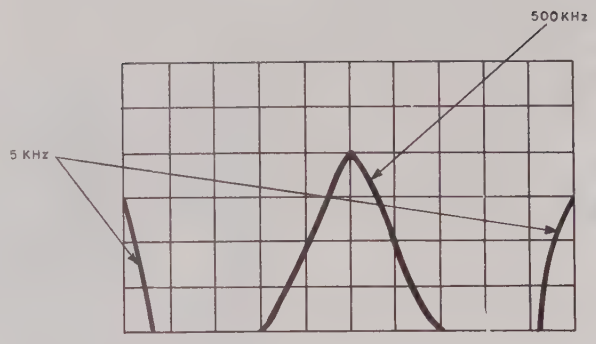


Figure 4–4. 1-KHz-per-centimeter scan width display.

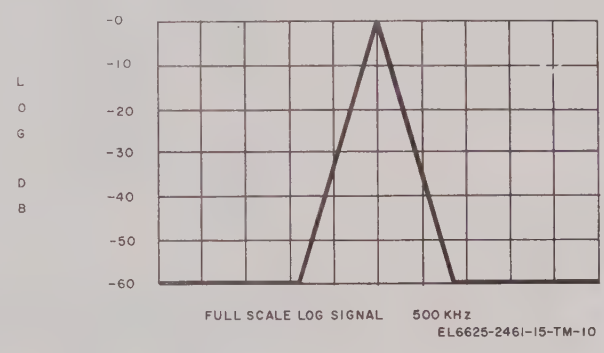


Figure 4–5. 60-dB logarithmic display.

noise level. This signal level should be no greater than −100 dbm.

j. 60 db Log Scale Alignment.

(1) Set the analyzer controls as follows:

60 DB LOG–LINEAR	60 DB LOG
FINE TUNING	Centered
SCAN WIDTH–CPS/CM	1K
IF GAIN	Nominal
VIDEO FILTER	OUT
INPUT ATTENUATOR	OUT

(2) Apply a 500-kHz signal to the SIGNAL INPUT connector.

(3) With the DB SHAPE potentiometer R61, set the screen grid voltage (pin #6) of V8 (6AU6) for +22 volts.

(4) Increase signal (500 kHz) output of signal generator to provide full scale deflection (6 cm).

(5) Check the log steps (fig. 4–5).

(6) If log steps are out of spec, the DB RANGE potentiometer (R69) can be adjusted to

compensate for error. After each adjustment use the signal generator attenuator to maintain full scale deflection before checking log steps (fig. 4–5).

k. Amplitude Flatness Alignment.

(1) Set analyzer controls as follows:

60 DB LOG–LINEAR	Linear
FINE TUNING	Centered
SCAN WIDTH–CPS/CM	10K
IF GAIN	Centered
FILTER	OUT
INPUT ATTENUATOR	OUT

(2) Apply a 450-kHz signal to the SIGNAL INPUT connector of plug-in unit and set this signal to the extreme right side of the graticule. Adjust the slug of L2, to peak this signal.

(3) Increase the input signal to 550 kHz and set this signal to the extreme left side of graticule. Adjust the slug of L1 to peak this signal.

(4) Observe the amplitude of the 550-kHz signal. Gradually decrease the generator frequency to 450 kHz, observing the amplitude change as the signal moves from left to right on the graticule. The amplitude change should be no greater than 4 db. If greater than 4 db, continue adjusting L1 and L2 for optimum flatness.

l. Tuning Dial Alignment Procedure (PSA 231 Only). The tuning curve of the local oscillator is controlled by the shape of the plates in the tuning capacitor. This shape has been carefully controlled to insure an optimum fit with the tuning dial. For these reasons, only the ends of the dial must be adjusted. The upper end frequencies are affected by the setting of trimmer capacitors C207, C208, C209 and C211; the lower end frequencies are set by the slugs incoils L201, L202, L203 and L204. Align each band as follows:

(1) Set the SCAN WIDTH–CPS/CM switch to 2K and the 60 DB LOG–LINEAR switch to LINEAR.

(2) With BAND SWITCH set to the appropriate band, set tuning dial pointer to lowest frequency of the band, Provie a corresponding signal from a signal generator to SIGNAL INPUT connector. Adjust the coil slug of that band ((3) below) to center this frequency on the graticule.

(3) On the same band, set tuning dial pointer to the highest frequency. Provide a corresponding signal from the signal generator. With the trimmer capacitor of that band, center this frequency on the graticule. The coil and trimmer of the same band interact to some degree. Therefore it is necessary to repeat step (2) and this step on each band until the dial frequencies agree with the actual frequencies.

Band	*Coil*	*Trimmer*
1 (0.6 to 1.7 MHz)	L204	C211
2 (1.7 to 5.5 MHz)	L203	C209
3 (5.5 to 16 MHz)	L202	C208
4 (16 to 36 MHz)	L201	C207

NOTE

Be careful that the frequency set on the center graticule is the actual frequency and not the image. To distinguish the correct frequency, increase the generator frequency. If the signal moves to the left of the screen, this is the correct frequency. If it moves to the right it is the image.

m. Mixer Balance Alignment (PSA 231 Only). The purpose of the adjustment is to minimize spurious response due to local oscillator feedthru at 600-kHz, on band 1. This is accomplished as follows:

(1) Remove input signal. Set SCAN WIDTH–CPS/CM switch to 2K and 60 DB LOG–LINEAR switch to LINEAR.

(2) Set BAND SWITCH to band 1. Adjust TUNING until a spurious signal is visible in the vicinity of 600 kHz.

(3) Adjust MIXER BAL potentiometer R6 to minimize the amplitude of this signal.

n. Mixer Balance Alignment (PSA 230 Only). The purpose of the adjustment is to minimize the spurious response. This is accomplished as follows:

(1) Connect the signal generator to the OSCILLATOR INPUT connector.

(2) Adjust the signal generator to provide 1.1 MHz at a level of 100 millivolts. A large spurious signal will be seen around this frequency.

(3) Adjust MIXER BAL potentiometer R6 to minimize the amplitude of the spurious signal.

o. Input Attenuator.

(1) Set the SCAN WIDTH–CPS/CM to 2K and 60 DB LOG–LINEAR switch to LINEAR.

(2) Apply an RF signal within analyzer range and center this frequency on the screen.

(3) Switch in all INPUT ATTENUATOR switches; adjust the output of the signal generator to −20 dbm.

(4) With IF GAIN control set a reference of this frequency on scale.

(5) Switch each INPUT ATTENUATOR-OUT and by substitution method, between the generator attenuator and the analyzer attenuator, measure the actual attenuation of each switch. The attenuation error shall be no greater than ±5%.

p. Sensitivity. To check sensitivity, perform the following steps:

(1) Set the plug-in controls as follows:

60 DB LOG-LINEAR	LINEAR
SCAN WIDTH-CPS/CM	10K
IF GAIN	Maximum (cw)
VIDEO FILTER	OUT
INPUT ATTENUATOR	OUT

(2) Apply an unmodulated RF signal at any frequency within the range of the analyzer. Tune the analyzer to display the signal.

(3) Turn signal generator output down to −100 dbm. This signal should be visible above the display noise level.

q. Video Filter. The 50-millisecond video filter is preset at the factory. No alignment is needed.

r. Intermodulation Distortion Check. The level of intermodulation (IM) produced by the analyzer can be determined by the following test:

(1) Set the analyzer controls as follows:

60 DB LOG-LINEAR	60 DB LOG
IF GAIN	Maximum (cw)
VIDEO FILTER	OUT
SCAN WIDTH-CPS/CM	1K

(2) Apply two full scale signals (5 kHz apart) to the analyzer (fig. 4-6). Vary the frequency separation until IM products are visible on the skirts. All IM products should be 60 db down, as shown in figure 4-6.

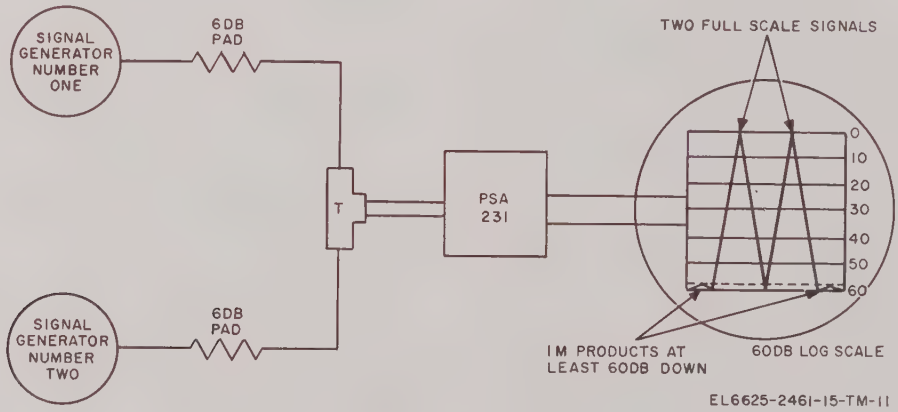


Figure 4-6. Intermodulation distortion test setup.

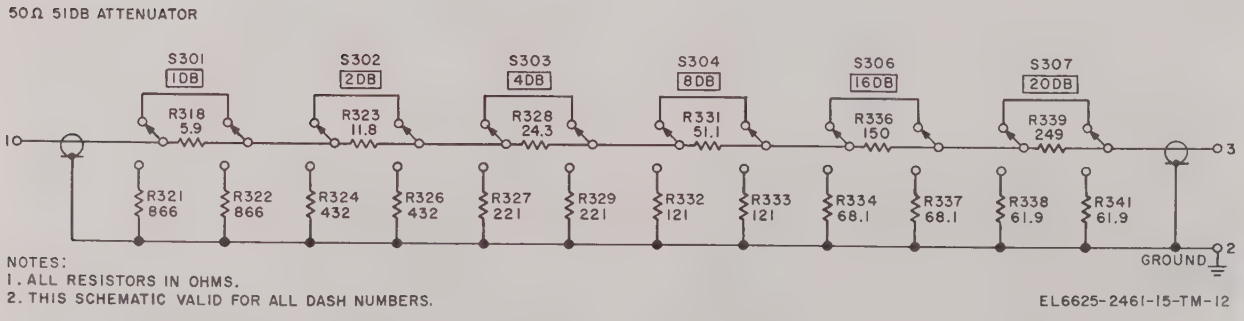


Figure 4-7. Input attenuator, schematic diagram.

Figure 4-8. Model PSA 230, schematic diagram.
(Located in back of manual)

Figure 4-9. Model PSA 231, schematic diagram.
(Located in back of manual)

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U. S. Army Index of Modification Work Orders.
TM 38-750	The Army Maintenance Management System (TAMMS).

APPENDIX B

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

B-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

b. Test. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc. This is accomplished with external test equipment and does not include operation of the equipment and operator type tests using internal meters or indicating devices.

c. Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

d. Adjust. To rectify to the extent necessary to bring into proper operating range.

e. Align. To adjust two or more components or assemblies of an electrical or mechanical system so that their functions are properly synchronized. This does not include setting the frequency control knob of radio receivers or transmitters to the desired frequency.

f. Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

g. Install. To set up for use in an operational environment such as an encampment, site, or vehicle.

h. Replace. To replace unserviceable items with serviceable like items.

i. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes, but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

j. Overhaul. Normally, the highest degree of maintenance performed by the Army in order to minimize time work in process is consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment. Overhaul normally does not return an item to like new, zero mileage, or zero hour condition.

k. Rebuild. The highest degree of materiel maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance category. Rebuild reduces to zero the hours or miles the equipment, or component thereof, has been in use.

l. Symbols. The uppercase letter placed in the appropriate column indicates the lowest level at

which that particular maintenance function is to be performed.

B–3. Explanation of Format

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Functional Group. Column 2 lists the noun names of components, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

Code	*Maintenance category*
C	Operator/crew
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

d. Column 4, Tools and Test Equipment. Column 4 specifies, by code, those tools and test equipments required to perform the designated function. The numbers appearing in this column refer to specific tools and test equipment which are identified in table I.

e. Column 5, Remarks. Self-explanatory.

B–4. Explanation of Format of Table I, Tool and Test Equipment Requirements

The columns in table I, are as follows:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the *Tools and equipment column* of the maintenance allocation chart. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number of the specific tool or test equipment.

e. Tool Number. Not used.

SECTION II. MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
1	SPECTRUM ANALYZER PSA-231	O												Visual.
			H										1-7	
				O									8	Exterior only.
									F				7	
										F			7	Repair by replacement defective switches and knobs.
										H			1-7	

TABLE I. TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
1	H,D	OSCILLOSCOPE, HEWLETT PACKARD MODEL 140A	6625-957-0509	
2	H,D	OSCILLOSCOPE AN/USM-281	6625-053-3112	
3	H,D	SIGNAL GENERATOR AN/GRM-50	6625-868-8353	
4	H,D	SIGNAL GENERATOR AN/URM-127	6625-783-5965	
5	H,D	MULTIMETER TS-352B/U	6625-553-0142	
6	H,D	FIXED ATTENUATOR CN-85A/U	5985-665-5313	
7	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	5180-605-0079	
8	O	TOOL KIT, ELECTRONIC EQUIPMENT TK-101/G	5180-064-5178	

APPENDIX C

ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS

Section I. INTRODUCTION

C-1. Scope

This appendix lists repair parts required for the performance of organizational, direct support, general support, and depot maintenance of the PSA-231.

NOTE

No special tools, test, and support equipment are required.

C-2. General

This repair parts list is divided into the following sections:

a. Repair Parts for Organizational Maintenance—Section II. A list of repair parts authorized for the performance of maintenance at the organizational level.

b. Repair Parts for Direct Support, General Support, and Depot Maintenance—Section III. A list of repair parts authorized for the performance of maintenance at the direct support, general support, and depot level.

c. Index—Federal Stock Number Cross-Reference to Figure and Item Number or Reference Designation—Section IV. A list of Federal stock numbers in ascending numerical sequence, followed by a list of reference numbers appearing in ascending alphanumerical sequence, cross-referenced to the figure number and reference designation.

d. Index—Reference Designation Cross-Reference to Page Number—Section V. A list of reference designations cross-referenced to page numbers.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular lists:

a. Source, Maintenance, and Recoverability Codes (SMR).

(1) Source codes indicate the selection status and source for the list item. Source codes are—

Code	*Explanation*
P	Repair parts which are stocked in or supplied from the GSA/DSA or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
P9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment, which are stocked and supplied by the Army COMSEC logistic system, and which are not subject to the provisions of AR 380-41.
P10	Assigned to items which are NSA design controlled: special tools, test, measuring and diagnostic equipment for COMSEC support, which are accountable under the provisions of AR 380-41, and which are stocked and supplied by the Army COMSEC logistic system.
M	Repair parts which are not procured or stocked, but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies which are not procured or stocked and the mortality of

Code	Explanation
	which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement for such items will be filled by use of the next higher assembly or component.
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain same through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above DS and GS level or returned to depot supply level.

(2) Maintenance codes indicate the lowest category of maintenance authorized to install the listed item. The maintenance level codes are—

Code	Explanation
C	Operator/crew
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

(3) Recoverability codes indicate whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are—

Code	Explanation
R	Repair parts and assemblies that are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High-dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high-dollar value usable casings or castings.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. Indicates the Federal item name and any additional description of the item required. The index number has been included as part of the description to aid in the location of "same as" items. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses.

d. Unit on Measure (U/M). A two-character alphabetical abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. Indicates the quantity of the item used in the PSA–231. Subsequent appearances of the same item in the same assembly are indicated by the letters "REF".

f. Allowances (15-Day Organizational Maintenance, 30-Day DS/GS Maintenance, 1 Year Per Equipment (Contingency), and Depot Maintenance). Items authorized for requisition as required are identified by an asterisk in the allowance column.

g. Illustrations.

(1) *Figure number.* Indicates the figure number in which the item is shown.

(2) *Item number or reference designation.* Indicates the reference designation used to identify the item in the illustration.

C–4. Location of Repair Parts

a. This appendix contains two cross-reference indexes (secs. IV and V) to be used to locate a repair part when either the Federal stock number, reference number (manufacturer's part number), or reference designation is known. The first column in each index is prepared in numerical or alphanumerical sequence in ascending order. Where a Federal stock number is not listed, refer to the reference number (manufacturer's part numbers) immediately following the Federal stock number.

b. When the Federal stock number or reference number is known, follow the procedures given in (1) and (2) below.

(1) Refer to the index of Federal stock numbers (sec. IV) and locate the Federal stock number or reference number. The Federal stock number or reference number is cross-referenced to the applicable figure and reference designation.

(2) When the reference designation is determined, refer to the reference designation index (sec. V). The reference designations are listed in alphanumerical ascending order and are cross-referenced to the page number on which they appear in the repair parts list (sec. II or III). Refer to the page number noted in the index and locate the reference designation in the repair parts list (col. 7b or 10b). If the description column indicates that it is a "SAME AS" item, locate the first appearance of the item by the index number referenced.

c. When the reference designation is known, follow the procedure given in *b*(2) above.

d. When neither the FSN, reference number, nor reference designation is known, identify the part in the illustration and follow directions given in *c* above, or scrutinize column 3 of the repair parts list (sec. II or III).

C–5. Federal Supply Code for Manufacturers

Code	*Manufacturer's name*
00656	Aerovox Corp.
02660	Bunker Ramo Corp., Amphenol Connector Div.
06432	All Craft Screw and Hardware Co., Inc.
07137	Tec, Inc.
07886	National Radio Co., Inc., Commercial Products Div.
19217	Medalist Industries, Inc., Canvas Products Div.
23369	Nelson Ross Electronics, Inc.
56289	Sprague Electric Co.
71450	CTS Corp.
71590	Globe Union Inc., Centralab Division
71785	Cinch Mfg. Co. and Howard B. Jones Div.
72653	G. C. Electronics Co., A Division of Hydrometals, Inc.
72825	Hugh H. Eby, Inc.
72982	Erie Technological Products Div.
73445	Amperex Electronic Corp.
76493	J. W. Miller Company
78189	Illinois Tool Works, Inc., Shakeproof Division
80131	Electronic Industries Association
81312	Winchester Electronics Division Litton Industries, Inc.
81349	Military Specifications
82252	Staver Mfg. Co., Inc.
83330	Herman H. Smith, Inc.
91506	Augat, Inc.
91637	Dale Electronics, Inc.
91737	ITT Gremar, Inc.
94222	South Co., Inc.
95146	Alco Electronics Products, Inc.
99800	Delevan Div., American Precision Industries, Inc.

[Next page is C–5]

SECTION II REPAIR PARTS FOR ORGANIZATIONAL MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION Reference Number & Mfr Code / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 15-DAY ORGANIZATIONAL MAINTENANCE ALW (a) 1-5	(b) 6-20	(c) 21-50	(d) 51-100	(7) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
	6625-123-3131	A001 SPECTRUM ANALYZER PSA-231 (THIS ITEM IS NONEXPENDABLE)								
P-O	6240-892-4420	A115 LAMP,GLOW: NE2D (81349)	EA	1	*	*	*	*	4-9	DS1

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
	6625-123-3131	A001 SPECTRUM ANALYZER PSA-231 (THIS ITEM IS NONEXPENDABLE)													
A-H-S		A002 ATTENUATOR ASSY: B1000-448-6 (23369)		EA	1									4-7	A3
A-F-R		A003 CABLE ASSY RF: CK1000-593-18 (23369)		EA	1									4-3	W205
P-F	6145-583-9268	A003A CABLE RF: RG-122/U (81349)		FT	3	*	*	*	*	*	*	*	*	4-3	W205A
P-F	5935-539-0291	A004 CONNECTOR,PLUG,ELECTRICAL: UG-1033/U (81349)		EA	1	*	*	*	*	*	*	*	*	4-3	P205
P-H	5905-713-1406	A005 RESISTOR,FIXED,FILM: RN65D11R8F (81349)		EA	1				*	*	*	*	*	4-7	R323
P-H	5905-989-1184	A006 RESISTOR,FIXED,FILM: RN65D1210F (81349)		EA	2				*	*	*	*	*	4-7	R332
P-H	5905-989-1184	A007 RESISTOR,FIXED,FILM: SAME AS A006		EA	REF				*	*	*	*	*	4-7	R333
P-H	5905-978-7095	A008 RESISTOR,FIXED,FILM: RN65D1500F (81349)		EA	1				*	*	*	*	*	4-7	R336
P-H	5905-990-4196	A009 RESISTOR,FIXED,FILM: RN65D2210F (81349)		EA	2				*	*	*	*	*	4-7	R327
P-H	5905-990-4196	A010 RESISTOR,FIXED,FILM: SAME AS A009		EA	REF				*	*	*	*	*	4-7	R329
P-H	5905-954-6006	A011 RESISTOR,FIXED,FILM: RN65D24R3F (81349)		EA	1				*	*	*	*	*	4-7	R328
P-H	5905-068-5720	A012 RESISTOR,FIXED,FILM: RN65D2490F (81349)		EA	1				*	*	*	*	*	4-7	R339
P-H	5905-763-4370	A013 RESISTOR,FIXED,FILM: RN65D4320F (81349)		EA	2				*	*	*	*	*	4-7	R324
P-H	5905-763-4370	A014 RESISTOR,FIXED,FILM: SAME AS A013		EA	REF				*	*	*	*	*	4-7	R326
P-H	5905-407-1502	A015 RESISTOR,FIXED,FILM: MFF1-2-5-90HMSPORM1PCTT1 (91367)		EA	1				*	*	*	*	*	4-7	R318
P-H	5905-958-3498	A016 RESISTOR,FIXED,FILM: RN65D51R1F (81349)		EA	1				*	*	*	*	*	4-7	R331
P-H	5905-079-4057	A017 RESISTOR,FIXED,FILM: RN65D61R9F (81349)		EA	2				*	*	*	*	*	4-7	R338
P-H	5905-079-4057	A018 RESISTOR,FIXED,FILM: SAME AS A017		EA	REF				*	*	*	*	*	4-7	R341
P-H	5905-079-7824	A019 RESISTOR,FIXED,FILM: RN65D68R1F (81349)		EA	2				*	*	*	*	*	4-7	R334
P-H	5905-079-7824	A020 RESISTOR,FIXED,FILM: SAME AS A019		EA	REF				*	*	*	*	*	4-7	R337
P-H	5905-990-5006	A021 RESISTOR,FIXED,FILM: RN65D8660F (81349)		EA	2				*	*	*	*	*	4-7	R321
P-H	5905-990-5006	A022 RESISTOR,FIXED,FILM: SAME AS A021		EA	REF				*	*	*	*	*	4-7	R322
P-F	5930-063-6820	A023 SWITCH,TOGGLE: 7201 (09353)		EA	6	*	*	*	*	*	*	*	*	4-7	S301
P-F	5930-063-6820	A024 SWITCH,TOGGLE: SAME AS A023		EA	REF	*	*	*	*	*	*	*	*	4-7	S302
P-F	5930-063-6820	A025 SWITCH,TOGGLE: SAME AS A023		EA	REF	*	*	*	*	*	*	*	*	4-7	S303
P-F	5930-063-6820	A026 SWITCH,TOGGLE: SAME AS A023		EA	REF	*	*	*	*	*	*	*	*	4-7	S304
P-F	5930-063-6820	A027 SWITCH,TOGGLE: SAME AS A023		EA	REF	*	*	*	*	*	*	*	*	4-7	S306
P-F	5930-063-6820	A028 SWITCH,TOGGLE: SAME AS A023		EA	REF	*	*	*	*	*	*	*	*	4-7	S307

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
A-H-S		A029 BASIC UNIT: A1001-489 (23369)		EA	1									4-3	A1
P-H	5910-810-4852	A030 CAPACITOR,FIXED,CERAMIC: DD6-103 (71590)		EA	20				*	*	*	*	*	4-9	C2
P-H	5910-810-4852	A031 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C3
P-H	5910-810-4852	A032 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C4
P-H	5910-810-4852	A033 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C6
P-H	5910-810-4852	A034 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C7
P-H	5910-810-4852	A035 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C14
P-H	5910-810-4852	A036 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C17
P-H	5910-810-4852	A037 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C18
P-H	5910-810-4852	A038 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C21
P-H	5910-810-4852	A039 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C22
P-H	5910-810-4852	A040 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C28
P-H	5910-810-4852	A041 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C30
P-H	5910-810-4852	A042 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C32
P-H	5910-810-4852	A043 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C34
P-H	5910-810-4852	A044 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C51
P-H	5910-810-4852	A045 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C52
P-H	5910-810-4852	A046 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C53
P-H	5910-810-4852	A047 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C54
P-H	5910-810-4852	A048 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C56
P-H	5910-810-4852	A049 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C59
P-H	5910-280-8393	A050 CAPACITOR,FIXED,CERAMIC: DD102 (71590)		EA	5				*	*	*	*	*	4-9	C15
P-H	5910-280-8393	A051 CAPACITOR,FIXED,CERAMIC: SAME AS A050		EA	REF				*	*	*	*	*	4-9	C19
P-H	5910-280-8393	A052 CAPACITOR,FIXED,CERAMIC: SAME AS A050		EA	REF				*	*	*	*	*	4-9	C24
P-H	5910-280-8393	A053 CAPACITOR,FIXED,CERAMIC: SAME AS A050		EA	REF				*	*	*	*	*	4-9	C43
P-H	5910-280-8393	A054 CAPACITOR,FIXED,CERAMIC: SAME AS A050		EA	REF				*	*	*	*	*	4-9	C44
P-H	5910-850-7991	A055 CAPACITOR,FIXED,MICA: CM15E151J (81349)		EA	1				*	*	*	*	*	4-9	C9
P-H	5910-765-6226	A056 CAPACITOR,FIXED,MICA: CM15E161J (81349)		EA	1				*	*	*	*	*	4-9	C12
P-H	5910-256-5589	A057 CAPACITOR,FIXED,MICA: CM15E471J (81349)		EA	1				*	*	*	*	*	4-9	C33

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CMTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5910-832-5724	A058 CAPACITOR,FIXED,MICA: CM15E680J (81349)		EA	1				*	*	*	*	*	4-9	C11
P-H	5910-889-4462	A059 CAPACITOR,FIXED,PAPER: 192P47392 (56289)		EA	1				*	*	*	*	*	4-9	C48
P-H	5910-787-2930	A060 CAPACITOR,FIXED,PAPER: C296ABA100K (73445)		EA	13				*	*	*	*	*	4-9	C13
P-H	5910-787-2930	A061 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C16
P-H	5910-787-2930	A062 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C23
P-H	5910-787-2930	A063 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C27
P-H	5910-787-2930	A064 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C31
P-H	5910-787-2930	A065 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C36
P-H	5910-787-2930	A066 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C37
P-H	5910-787-2930	A067 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C38
P-H	5910-787-2930	A068 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C39
P-H	5910-787-2930	A069 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C42
P-H	5910-787-2930	A070 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C47
P-H	5910-787-2930	A071 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C49
P-H	5910-787-2930	A072 CAPACITOR,FIXED,PAPER: SAME AS A060		EA	REF				*	*	*	*	*	4-9	C57
P-H	5910-899-3799	A073 CAPACITOR,FIXED,PAPER: P829221V28 (00656)		EA	2				*	*	*	*	*	4-9	C1
P-H	5910-899-3799	A074 CAPACITOR,FIXED,PAPER: SAME AS A073		EA	REF				*	*	*	*	*	4-9	C8
P-H	5910-401-7320	A075 CAPACITOR,FIXED,PAPER: V161-440 (00656)		EA	1				*	*	*	*	*	4-9	C46
P-H	5910-763-6943	A076 CAPACITOR,VAR,CERAMIC: 538-000-90B (72982)		EA	2				*	*	*	*	*	4-9	C26
P-H	5910-763-6943	A077 CAPACITOR,VAR,CERAMIC: SAME AS A076		EA	REF				*	*	*	*	*	4-9	C29
P-H	5910-903-3714	A078 CAPACITOR,VAR,CERAMIC: 538-000-94D (72982)		EA	1				*	*	*	*	*	4-9	C41
X-H		A079 CHASSIS,ELECTRICAL EQUIPMENT		EA	1									4-9	MP1
P-H	5950-351-0394	A080 COIL,RF: A1000-110-2 (23369)		EA	1				*	*	*	*	*	4-9	L2
P-H		A081 COIL,RF: A1000-247 (23369)		EA	1				*	*	*	*	*	4-9	L1
P-F	5935-623-7199	A082 CONNECTOR,PLUG,ELECTRICAL: 26-4100-24P (02660)		EA	2	*	*	*	*	*	*	*	*	4-9	P1
P-F	5935-623-7199	A083 CONNECTOR,PLUG,ELECTRICAL: SAME AS A082		EA	REF	*	*	*	*	*	*	*	*	4-9	P2
P-H	5305	A084 SCREW,MACHINE: BHMS4-40X1-4 (06432)		EA	1				*	*	*	*	*		H1
P-H	5310	A085 WASHER,LOCK: WLINTN04 (06432)		EA	1				*	*	*	*	*		H2
P-H	5310	A086 NUT,PLAIN,HEX: NUTHEX4-40 (06432)		EA	1				*	*	*	*	*		H3

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-F	5935-258-2920	A087 CONNECTOR,RECP,ELECTRICAL: M7SLRN (81312)		EA	1	*	*	*	*	*	*	*	*	4-9	J7
P-F	5935-280-2928	A088 CONNECTOR,RECP,ELECTRICAL: UG625BU (81349)		EA	4	*	*	*	*	*	*	*	*	4-9	J1
P-F	5935-280-2928	A089 CONNECTOR,RECP,ELECTRICAL: SAME AS A088		EA	REF	*	*	*	*	*	*	*	*	4-9	J6
P-F	5935-280-2928	A090 CONNECTOR,RECP,ELECTRICAL: SAME AS A088		EA	REF	*	*	*	*	*	*	*	*	4-9	J3
P-F	5935-280-2928	A091 CONNECTOR,RECP,ELECTRICAL: SAME AS A088		EA	REF	*	*	*	*	*	*	*	*	4-9	J4
P-H	5955-486-8335	A092 CRYSTAL FILTER REPLACEMENT KIT: A1001-769 (23369) Consisting of R32,R33,R34,RL2,RL3,RL4, Y1,Y2		EA	1				*	*	*	*	*	4-9	
P-H	5960-262-0167	A093 ELECTRON TUBE: 12AT7WA (81349)		EA	4				*	*	*	*	*	4-9	V5
P-H	5960-262-0167	A094 ELECTRON TUBE: SAME AS A093		EA	REF				*	*	*	*	*	4-9	V10
P-H	5960-262-0167	A095 ELECTRON TUBE: SAME AS A093		EA	REF				*	*	*	*	*	4-9	V12
P-H	5960-262-0167	A096 ELECTRON TUBE: SAME AS A093		EA	REF				*	*	*	*	*	4-9	V13
P-H	5960-577-1367	A097 ELECTRON TUBE: 12AU6 (81349)		EA	3				*	*	*	*	*	4-1	V1
P-H	5960-577-1367	A098 ELECTRON TUBE: SAME AS A097		EA	REF				*	*	*	*	*	4-9	V2
P-H	5960-577-1367	A099 ELECTRON TUBE: SAME AS A097		EA	REF				*	*	*	*	*	4-9	V3
P-H	5960-166-7646	A100 ELECTRON TUBE: 12BE6 (81349)		EA	1				*	*	*	*	*	4-9	V4
P-H	5960-079-5079	A101 ELECTRON TUBE: 6AS6 (81349)		EA	1				*	*	*	*	*	4-9	V11
P-H	5960-082-0038	A102 ELECTRON TUBE: 6AU6A (81349)		EA	2				*	*	*	*	*	4-9	V8
P-H	5960-082-0038	A103 ELECTRON TUBE: SAME AS A102		EA	REF				*	*	*	*	*	4-9	V9
P-H	5960-188-3602	A104 ELECTRON TUBE: 6BH6 (81349)		EA	1				*	*	*	*	*	4-9	V6
P-H	5960-878-1889	A105 ELECTRON TUBE: 6201 (81349)		EA	1				*	*	*	*	*	4-9	V7
X-H		A106 FOOT		EA	1									2-2	MP2
P-F	5325-937-2015	A107 GROMMET,RUBBER: 91121 (83330)		EA	1	*	*	*	*	*	*	*	*	2-2	MP3
P-H	5340	A108 HANDLE,BOW: A1000-204 (19207)		EA	1				*	*	*	*	*	2-2	MP4
P-H	5305	A109 SCREW,MACHINE: BHMS6-32X1-4 (06432)		EA	1				*	*	*	*	*		H4
P-H	5355	A110 KNOB: C1000-124-11S (23369)		EA	1				*	*	*	*	*	2-2	MP5
P-H	5355	A111 KNOB: C1000-124-6 (23369)		EA	1				*	*	*	*	*	2-2	MP6
P-H	5305	A112 SETSCREW: SSCR6-32X3-16 (06432)		EA	1				*	*	*	*	*		H5
P-H	5355	A113 KNOB: C1000-124-3 (23369)		EA	1				*	*	*	*	*	2-2	MP7
P-H	5305	A114 SETSCREW: SSCR4-40X1-8 (06432)		EA	1				*	*	*	*	*		H6
P-O	6240-892-4420	A115 LAMP,GLOW: NE2D (81349)		EA	1	*	*	*	*	*	*	*	*	4-9	DS1

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CMTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
M-H		A116 PANEL,FRONT: C1000-564 (23369)		EA	1									2-2	MP8
P-H	5305	A117 SCREW,MACHINE: BHMS6-32X3-8 (06432)		EA	1				*	*	*	*	*		H7
P-H	5305	A118 SCREW,MACHINE: BHMS6-32X1-2 (06432)		EA	1				*	*	*	*	*		H8
P-H	5310	A119 WASHER,FLAT: WFN06 (06432)		EA	1				*	*	*	*	*		H9
P-H	5310	A120 WASHER,LOCK: WLINTN06 (06432)		EA	1				*	*	*	*	*		H10
P-H	5310	A121 NUT,PLAIN,HEX: NUTHEX6-32 (06432)		EA	1				*	*	*	*	*		H11
M-H		A122 PLATE,LEFT: C1000-135 (23369)		EA	1									4-3	MP9
M-H		A123 PLATE,REAR: C1000-090 (23369)		EA	1									4-3	MP10
M-H		A124 PLATE,RIGHT: C1000-092 (23369)		EA	1									4-3	MP11
P-H	5325	A125 SCREW,MACHINE: FHMS6-32X5-16 (06432)		EA	1				*	*	*	*	*		H12
P-H	5905-279-2616	A126 RESISTOR,FIXED,COMPOSITION: RC20GF153J (81349)		EA	1				*	*	*	*	*	4-9	R21
P-H	5905-171-2003	A133 RESISTOR,FIXED,COMPOSITION: RC20GF200K1/2W5% (81349)		EA	1				*	*	*	*	*	4-9	R65
P-H	5905-190-8889	A134 RESISTOR,FIXED,COMPOSITION: RC20GF101J (81349)		EA	2				*	*	*	*	*	4-9	R1
P-H	5905-190-8889	A135 RESISTOR,FIXED,COMPOSITION: SAME AS A134		EA	REF				*	*	*	*	*	4-9	R76
P-H	5905-195-6806	A136 RESISTOR,FIXED,COMPOSITION: RC20GF102J (81349)		EA	5				*	*	*	*	*	4-9	R28
P-H	5905-195-6806	A137 RESISTOR,FIXED,COMPOSITION: SAME AS A136		EA	REF				*	*	*	*	*	4-9	R29
P-H	5905-195-6806	A138 RESISTOR,FIXED,COMPOSITION: SAME AS A136		EA	REF				*	*	*	*	*	4-9	R38
P-H	5905-195-6806	A139 RESISTOR,FIXED,COMPOSITION: SAME AS A136		EA	REF				*	*	*	*	*	4-9	R39
P-H	5905-195-6806	A140 RESISTOR,FIXED,COMPOSITION: SAME AS A136		EA	REF				*	*	*	*	*	4-9	R101
P-H	5905-185-8510	A141 RESISTOR,FIXED,COMPOSITION: RC20GF103J (81349)		EA	2				*	*	*	*	*	4-9	R22
P-H	5905-185-8510	A142 RESISTOR,FIXED,COMPOSITION: SAME AS A141		EA	REF				*	*	*	*	*	4-9	R93
P-H	5905-064-0555	A143 RESISTOR,FIXED,FILM: RN65D1002F (81349)		EA	1				*	*	*	*	*	4-9	R106
P-H	5905-195-6761	A144 RESISTOR,FIXED,COMPOSITION: RC20GF104J (81349)		EA	5				*	*	*	*	*	4-9	R46
P-H	5905-195-6761	A145 RESISTOR,FIXED,COMPOSITION: SAME AS A144		EA	REF				*	*	*	*	*	4-9	R62
P-H	5905-195-6761	A146 RESISTOR,FIXED,COMPOSITION: SAME AS A144		EA	REF				*	*	*	*	*	4-9	R88
P-H	5905-195-6761	A147 RESISTOR,FIXED,COMPOSITION: SAME AS A144		EA	REF				*	*	*	*	*	4-9	R119
P-H	5905-195-6761	A148 RESISTOR,FIXED,COMPOSITION: SAME AS A144		EA	REF				*	*	*	*	*	4-9	R121
P-H	5905-192-0390	A149 RESISTOR,FIXED,COMPOSITION: RC20GF105J (81349)		EA	3				*	*	*	*	*	4-9	R7
P-H	5905-192-0390	A150 RESISTOR,FIXED,COMPOSITION: SAME AS A149		EA	REF				*	*	*	*	*	4-9	R8

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5905-192-0390	A151 RESISTOR,FIXED,COMPOSITION: SAME AS A149		EA	REF				*	*	*	*	*	4-9	R97
P-H	5905-279-1868	A152 RESISTOR,FIXED,COMPOSITION: RC20GF115J (81349)		EA	1				*	*	*	*	*	4-9	R91
P-H	5905-299-1541	A153 RESISTOR,FIXED,COMPOSITION: RC20GF151J (81349)		EA	3				*	*	*	*	*	4-9	R13
P-H	5905-299-1541	A154 RESISTOR,FIXED,COMPOSITION: SAME AS A153		EA	REF				*	*	*	*	*	4-9	R17
P-H	5905-299-1541	A155 RESISTOR,FIXED,COMPOSITION: SAME AS A153		EA	REF				*	*	*	*	*	4-9	R23
P-H	5905-279-3513	A156 RESISTOR,FIXED,COMPOSITION: RC20GF221J (81349)		EA	2				*	*	*	*	*	4-9	R16
P-H	5905-279-3513	A157 RESISTOR,FIXED,COMPOSITION SAME AS A156		EA	REF				*	*	*	*	*	4-9	R24
P-H	5905-279-1876	A158 RESISTOR,FIXED,COMPOSITION: RC20GF222J (81349)		EA	5				*	*	*	*	*	4-9	R3
P-H	5905-279-1876	A159 RESISTOR,FIXED,COMPOSITION: SAME AS A158		EA	REF				*	*	*	*	*	4-9	R11
P-H	5905-279-1876	A160 RESISTOR,FIXED,COMPOSITION: SAME AS A158		EA	REF				*	*	*	*	*	4-9	R26
P-H	5905-279-1876	A161 RESISTOR,FIXED,COMPOSITION: SAME AS A158		EA	REF				*	*	*	*	*	4-9	R71
P-H	5905-279-1876	A162 RESISTOR,FIXED,COMPOSITION: SAME AS A158		EA	REF				*	*	*	*	*	4-9	R72
P-H	5905-171-2004	A163 RESISTOR,FIXED,COMPOSITION: RC20GF223J (81349)		EA	1				*	*	*	*	*	4-9	R100
P-H	5905-192-0667	A164 RESISTOR,FIXED,COMPOSITION: RC20GF224J (81349)		EA	3				*	*	*	*	*	4-9	R27
P-H	5905-192-0667	A165 RESISTOR,FIXED,COMPOSITION: SAME AS A164		EA	REF				*	*	*	*	*	4-9	R63
P-H	5905-192-0667	A166 RESISTOR,FIXED,COMPOSITION: SAME AS A164		EA	REF				*	*	*	*	*	4-9	R64
P-H	5905-279-1880	A167 RESISTOR,FIXED,COMPOSITION: RC20GF272J (81349)		EA	1				*	*	*	*	*	4-9	R56
P-H	5905-190-8865	A168 RESISTOR,FIXED,COMPOSITION: RC20GF274J (81349)		EA	3				*	*	*	*	*	4-9	R36
P-H	5905-190-8865	A169 RESISTOR,FIXED,COMPOSITION: SAME AS A168		EA	REF				*	*	*	*	*	4-9	R86
P-H	5905-190-8865	A170 RESISTOR,FIXED,COMPOSITION: SAME AS A168		EA	REF				*	*	*	*	*	4-9	R87
P-H	5905-279-3499	A171 RESISTOR,FIXED,COMPOSITION: RC20GF273J (81349)		EA	2				*	*	*	*	*	4-9	R14
P-H	5905-279-3499	A172 RESISTOR,FIXED,COMPOSITION: SAME AS A171		EA	REF				*	*	*	*	*	4-9	R68
P-H	5905-279-1881	A173 RESISTOR,FIXED,COMPOSITION: RC20GF275J (81349)		EA	1				*	*	*	*	*	4-9	R89
P-H	5905-279-1890	A174 RESISTOR,FIXED,COMPOSITION: RC20GF391J (81349)		EA	1				*	*	*	*	*	4-9	R67
P-H	5905-279-2510	A175 RESISTOR,FIXED,COMPOSITION: RC20GF395J (81349)		EA	3				*	*	*	*	*	4-9	R30
P-H	5905-279-2510	A176 RESISTOR,FIXED,COMPOSITION: SAME AS A175		EA	REF				*	*	*	*	*	4-9	R37
P-H	5905-279-2510	A177 RESISTOR,FIXED,COMPOSITION: SAME AS A175		EA	REF				*	*	*	*	*	4-9	R92
P-H	5905-279-2616	A178 RESISTOR,FIXED,COMPOSITION: SAME AS A126		EA	2				*	*	*	*	*	4-9	R18
P-H	5905-279-2616	A179 RESISTOR,FIXED,COMPOSITION: SAME AS A126		EA	REF				*	*	*	*	*	4-9	R74

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5905-279-3504	A180 RESISTOR,FIXED,COMPOSITION: RC20GF472J (81349)		EA	2				*	*	*	*	*	4-9	R4
P-H	5905-279-3504	A181 RESISTOR,FIXED,COMPOSITION: SAME AS A180		EA	REF				*	*	*	*	*	4-9	R51
P-H	5905-254-9201	A182 RESISTOR,FIXED,COMPOSITION: RC20GF473J (81349)		EA	1				*	*	*	*	*	4-9	R99
P-H	5905-279-1897	A183 RESISTOR,FIXED,COMPOSITION: RC20GF560J (81349)		EA	1				*	*	*	*	*	4-9	R9
P-H	5905-195-6453	A184 RESISTOR,FIXED,COMPOSITION: RC20GF562J (81349)		EA	3				*	*	*	*	*	4-9	R31
P-H	5905-195-6453	A185 RESISTOR,FIXED,COMPOSITION: SAME AS A184		EA	REF				*	*	*	*	*	4-9	R105
P-H	5905-195-6453	A186 RESISTOR,FIXED,COMPOSITION: SAME AS A184		EA	REF				*	*	*	*	*	4-9	R108
P-H	5905-279-3838	A187 RESISTOR,FIXED,COMPOSITION: RC20GF565J (81349)		EA	1				*	*	*	*	*	4-9	R107
P-H	5905-249-3656	A188 RESISTOR,FIXED,COMPOSITION: RC20GF623J (81349)		EA	1				*	*	*	*	*	4-9	R52
P-H	5905-249-3661	A189 RESISTOR,FIXED,COMPOSITION: RC20GF683J (81349)		EA	4				*	*	*	*	*	4-9	R54
P-H	5905-249-3661	A190 RESISTOR,FIXED,COMPOSITION: SAME AS A189		EA	REF				*	*	*	*	*	4-9	R66
P-H	5905-249-3661	A191 RESISTOR,FIXED,COMPOSITION: SAME AS A189		EA	REF				*	*	*	*	*	4-9	R84
P-H	5905-249-3661	A192 RESISTOR,FIXED,COMPOSITION: SAME AS A189		EA	REF				*	*	*	*	*	4-9	R122
P-H	5905-299-1971	A193 RESISTOR,FIXED,COMPOSITION: RC20GF822J (81349)		EA	2				*	*	*	*	*	4-9	R50
P-H	5905-299-1971	A194 RESISTOR,FIXED,COMPOSITION: SAME AS A193		EA	REF				*	*	*	*	*	4-9	R55
P-H	5905-254-7100	A195 RESISTOR,FIXED,COMPOSITION: RC20GF913J (81349)		EA	1				*	*	*	*	*	4-9	R47
P-H	5905-279-1719	A196 RESISTOR,FIXED,COMPOSITION: RC32GF103J (81349)		EA	1				*	*	*	*	*	4-9	R41
P-H	5905-299-2040	A197 RESISTOR,FIXED,COMPOSITION: RC32GF472J (81349)		EA	1				*	*	*	*	*	4-9	R12
P-H	5905-171-1976	A198 RESISTOR,FIXED,COMPOSITION: RC42GF153J (81349)		EA	1				*	*	*	*	*	4-9	R2
P-H	5905-064-0555	A199 RESISTOR,FIXED,FILM: SAME AS A143		EA	1				*	*	*	*	*	4-9	R79
P-H	5905-814-3815	A200 RESISTOR,FIXED,FILM: RN65D1003F (81349)		EA	1				*	*	*	*	*	4-9	R102
P-H	5905	A201 RESISTOR,FIXED,FILM: RN65D2203F (81349)		EA	1				*	*	*	*	*	4-9	R82
P-H	5905-400-7461	A202 RESISTOR,FIXED,FILM: RN65D2701F (81349)		EA	1				*	*	*	*	*	4-9	R116
P-H	5905-937-2958	A203 RESISTOR,FIXED,FILM: RN65D2702F (81349)		EA	1				*	*	*	*	*	4-9	R78
P-H	5905-435-6932	A204 RESISTOR,FIXED,FILM: RN65D3301F (81349)		EA	1				*	*	*	*	*	4-9	R114
P-H	5905	A205 RESISTOR,FIXED,FILM: RN65D3302F (81349)		EA	1				*	*	*	*	*	4-9	R112
P-H	5905-491-4732	A206 RESISTOR,FIXED,FILM: RN65D5103F (81349)		EA	2				*	*	*	*	*	4-9	R103
P-H	5905-491-4732	A207 RESISTOR,FIXED,FILM: SAME AS A206		EA	REF				*	*	*	*	*	4-9	R109
P-H	5905-964-2219	A208 RESISTOR,FIXED,FILM: RN65D5621F (81349)		EA	1				*	*	*	*	*	4-9	R77

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5905	A209 RESISTOR,FIXED,FILM: RN65D6800F (81349)		EA	1				*	*	*	*	*	4-9	R117
P-H	5905	A210 RESISTOR,FIXED,FILM: RN65D6802F (81349)		EA	1				*	*	*	*	*	4-9	R111
P-H	5905	A211 RESISTOR,FIXED,W.W.: RW55G352J (81349)		EA	1				*	*	*	*	*	4-9	R118
P-H	5905-406-9705	A212 RESISTOR,VARIABLE: C1000-154-10 (23369)		EA	3				*	*	*	*	*	4-9	R57
P-H	5905-406-9705	A213 RESISTOR,VARIABLE: SAME AS A212		EA	REF				*	*	*	*	*	4-9	R58
P-H	5905-406-9705	A214 RESISTOR,VARIABLE: SAME AS A212		EA	REF				*	*	*	*	*	4-9	R59
P-H	5905-406-9706	A215 RESISTOR,VARIABLE: C1000-154-11 (23369)		EA	1				*	*	*	*	*	4-9	R69
P-H	5905-406-9707	A216 RESISTOR,VARIABLE: C1000-154-2 (23369)		EA	1				*	*	*	*	*	4-9	R49
P-H	5905-406-9708	A217 RESISTOR,VARIABLE: C1000-154-26 (23369)		EA	2				*	*	*	*	*	4-9	R48
P-H	5905-406-9708	A218 RESISTOR,VARIABLE: SAME AS A217		EA	REF				*	*	*	*	*	4-9	R98
P-H	5905-406-9709	A219 RESISTOR,VARIABLE,DUAL: C1000-154-3 (23369)		EA	4				*	*	*	*	*	4-9	R19,R104
P-H	5905-406-9709	A220 RESISTOR,VARIABLE,DUAL: SAME AS A219		EA	REF				*	*	*	*	*	4-9	R81,R83
P-H	5905-406-9710	A221 RESISTOR,VARIABLE: C1000-154-32 (23369)		EA	1				*	*	*	*	*	4-9	R6
P-H	5905-406-9711	A222 RESISTOR,VARIABLE: C1000-154-8 (23369)		EA	1				*	*	*	*	*	4-9	R96
P-H	5905-407-9712	A223 RESISTOR,VARIABLE: C1001-154-9		EA	1				*	*	*	*	*	4-9	R61
P-F	5960-521-9719	A224 RETAINER,ELECTRON TUBE: 21D3 (82252)		EA	1	*	*	*	*	*	*	*	*	4-1	MP12
P-F	5960-256-0587	A225 RETAINER,ELECTRON TUBE: 23D3 (82252)		EA	1	*	*	*	*	*	*	*	*	4-1	MP13
P-F	5960-273-2450	A226 RETAINER,ELECTRON TUBE: 24D3 (82252)		EA	1	*	*	*	*	*	*	*	*	4-1	MP14
P-H	5961-810-5463	A227 SEMICONDUCTOR,DEVICE,DIODE: IN456 (81349)		EA	1				*	*	*	*	*	4-9	CR3
P-H	5961-940-8568	A228 SEMICONDUCTOR,DEVICE,DIODE: IN459 (81349)		EA	1				*	*	*	*	*	4-9	CR5
P-H	5961-170-4430	A229 SEMICONDUCTOR,DEVICE,DIODE: IN34A (80131)		EA	3				*	*	*	*	*	4-9	CR1
P-H	5961-170-4430	A230 SEMICONDUCTOR,DEVICE,DIODE: SAME AS A229		EA	REF				*	*	*	*	*	4-9	CR2
P-H	5961-170-4430	A231 SEMICONDUCTOR,DEVICE,DIODE: SAME AS A229		EA	REF				*	*	*	*	*	4-9	CR4
P-H	5960-272-9094	A232 SHIELD,ELECTRON TUBE: TS102U02 (81349)		EA	1				*	*	*	*	*	4-3	E1
M-H		A233 CLAMP,LOOP: Z9-45-003 (71450)		EA	1										MP15
P-H	5935-260-0516	A234 SOCKET,ELECTRON TUBE: TS102P01 (81349)		EA	1				*	*	*	*	*	4-9	XV4
P-H	5935-051-5348	A235 SOCKET,ELECTRON TUBE: 9713-26 (72825)		EA	5				*	*	*	*	*	4-9	XV5
P-H	5935-051-5348	A236 SOCKET,ELECTRON TUBE: SAME AS A235		EA	REF				*	*	*	*	*	4-9	XV7
P-H	5935-051-5348	A237 SOCKET,ELECTRON TUBE: SAME AS A235		EA	REF				*	*	*	*	*	4-9	XV10

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5935-051-5348	A238 SOCKET,ELECTRON TUBE: SAME AS A235		EA	REF				*	*	*	*	*	4-9	XV12
P-H	5935-051-5348	A239 SOCKET,ELECTRON TUBE: SAME AS A235		EA	REF				*	*	*	*	*	4-9	XV13
P-H	5935-581-6400	A240 SOCKET,ELECTRON TUBE: 9727-50 (72825)		EA	7				*	*	*	*	*	4-9	XV1
P-H	5935-581-6400	A241 SOCKET,ELECTRON TUBE: SAME AS A240		EA	REF				*	*	*	*	*	4-9	XV2
P-H	5935-581-6400	A242 SOCKET,ELECTRON TUBE: SAME AS A240		EA	REF				*	*	*	*	*	4-9	XV3
P-H	5935-581-6400	A243 SOCKET,ELECTRON TUBE: SAME AS A240		EA	REF				*	*	*	*	*	4-9	XV6
P-H	5935-581-6400	A244 SOCKET,ELECTRON TUBE: SAME AS A240		EA	REF				*	*	*	*	*	4-9	XV8
P-H	5935-581-6400	A245 SOCKET,ELECTRON TUBE: SAME AS A240		EA	REF				*	*	*	*	*	4-9	XV9
P-H	5935-581-6400	A246 SOCKET,ELECTRON TUBE: SAME AS A240		EA	REF				*	*	*	*	*	4-9	XV11
P-H	5305	A247 SCREW,MACHINE: BHMS4-40X5-16 (06432)		EA	1				*	*	*	*	*		H13
P-H	5935-866-4298	A248 SOCKET,CRYSTAL: 8000AG2 (91506)		EA	2				*	*	*	*	*	4-1	XY1
P-H	5935-866-4298	A249 SOCKET,CRYSTAL: SAME AS A248		EA	REF				*	*	*	*	*	4-1	XY2
P-H	5305	A250 SCREW,MACHINE: BHMS2-56X1-4 (06432)		EA	1				*	*	*	*	*		H14
P-H	5310	A251 NUT,PLAIN,HEX: NUTHEX2-56 (06432)		EA	1				*	*	*	*	*		H15
P-H	5365	A252 SPACER,SLEEVE: 834 (83330)		EA	1				*	*	*	*	*		MP16
P-H	5305	A253 SCREW,MACHINE: BHMS6-32X5-16 (06432)		EA	1				*	*	*	*	*		H16
P-H		A254 WASHER,LOCK: SAME AS A120		EA	1				*	*	*	*	*		H17
P-H		A255 WASHER,FLAT: SAME AS A119		EA	1				*	*	*	*	*		H18
P-F	5930-503-4270	A256 SWITCH,PUSH: 992 (83330)		EA	1	*	*	*	*	*	*	*	*	4-9	S5
P-F	5930-979-8179	A257 SWITCH,ROTARY: PA107 (71590)		EA	1	*	*	*	*	*	*	*	*	4-9	S1
P-F	5930-059-8299	A258 SWITCH,TOGGLE: 956 (83330)		EA	3	*	*	*	*	*	*	*	*	4-9	S2
P-F	5930-059-8299	A259 SWITCH,TOGGLE: SAME AS A258		EA	REF	*	*	*	*	*	*	*	*	4-9	S3
P-F	5930-059-8299	A260 SWITCH,TOGGLE: SAME AS A258		EA	REF	*	*	*	*	*	*	*	*	4-9	S4
P-H	5940	A261 TERMINAL BOARD: 219-14 (71450)		EA	1				*	*	*	*	*	4-3	E2
P-H	5940-617-2673	A262 TERMINAL LUG: 2140-20-00 (78189)		EA	1				*	*	*	*	*	4-3	E3
P-H		A263 SCREW,MACHINE: SAME AS A247		EA	1				*	*	*	*	*		H19
P-H		A264 NUT,PLAIN,HEX: SAME AS A086		EA	1				*	*	*	*	*		H20
P-H	5940-959-6520	A265 TERMINAL LUG: 1413-6 (83330)		EA	1				*	*	*	*	*		E4
P-H		A266 SCREW,MACHINE: SAME AS A117		EA	1				*	*	*	*	*		H21

SECTION III' REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H		A267 NUT,PLAIN,HEX: SAME AS A121	EA	1				*	*	*	*	*		H22
P-H	5950-351-0395	A268 TRANSFORMER,RF: A1000-008-2A (23369)	EA	1				*	*	*	*	*	4-9	Z4
P-H		A269 NUT,PLAIN,HEX: SAME AS A121	EA	1				*	*	*	*	*		H23
P-H		A270 WASHER,LOCK: SAME AS A120	EA	1				*	*	*	*	*		H24
P-H	5950-401-7328	A271 TRANSFORMER,RF: A1000-009-1 (23369)	EA	5				*	*	*	*	*	4-9	Z1
P-H	5950-401-7328	A272 TRANSFORMER,RF: SAME AS A271	EA	REF				*	*	*	*	*	4-9	Z2
P-H	5950-401-7328	A273 TRANSFORMER,RF: SAME AS A271	EA	REF				*	*	*	*	*	4-9	Z3
P-H	5950-401-7328	A274 TRANSFORMER,RF: SAME AS A271	EA	REF				*	*	*	*	*	4-9	Z6
P-H	5950-401-7328	A275 TRANSFORMER,RF: SAME AS A271	EA	REF				*	*	*	*	*	4-7	Z7
A-H-S		A276 TUNING HEAD: A1001-490 (23369)	EA	1									4-3	A2
P-H		A277 SCREW,MACHINE: SAME AS A118	EA	1				*	*	*	*	*		H201
P-H	5330	A278 WASHER,NONMETALIC: WFNONMETN06 (06432)	EA	1				*	*	*	*	*		H202
P-H		A279 WASHER,LOCK: SAME AS A120	EA	1				*	*	*	*	*		H203
P-H		A280 NUT,PLAIN,HEX: SAME AS A121	EA	1				*	*	*	*	*		H204
P-H		A281 SCREW,MACHINE: SAME AS A253	EA	1				*	*	*	*	*		H205
P-H		A282 WASHER,LOCK: SAME AS A120	EA	1				*	*	*	*	*		H206
P-H	5340	A283 BRACKET,MOUNTING: A1000-747 (23369)	EA	1				*	*	*	*	*	4-1	MP201
P-H		A284 SCREW,MACHINE: SAME AS A253	EA	1				*	*	*	*	*		H207
P-H		A285 WASHER,LOCK: SAME AS A120	EA	1				*	*	*	*	*		H208
P-H		A286 WASHER,FLAT: SAME AS A119	EA	1				*	*	*	*	*		H209
M-H		A287 BRACKET,DIAL,DRIVE: B1000-576 (23369)	EA	1				*	*	*	*	*	4-3	MP202
P-H		A288 SCREW,MACHINE SAME AS A109	EA	1				*	*	*	*	*		H210
P-H		A289 WASHER,NONMETALIC: SAME AS A278	EA	1				*	*	*	*	*		H211
A-F-R		A290 CABLE ASSY SP. ELECTRICAL: A1001-488 (23369)	EA	1									4-3	W207
P-F	5935-259-6981	A291 CONNECTOR,PLUG,ELECTRICAL: M7PLSH19C (81312)	EA	1	*	*	*	*	*	*	*	*	4-3	P207
A-F-R		A292 CABLE ASSY RF: CK1000-593-12 (23369)	EA	1									4-2	W201
P-F	5935-972-9311	A293 CONNECTOR,RECP,ELECTRICAL: 5359 (91737)	EA	1	*	*	*	*	*	*	*	*	4-3	J201
A-F-R		A294 CABLE ASSY,RF: CK1000-593-13 (23369)	EA	1									4-2	W206
P-F	5935-539-0291	A295 CONNECTOR,PLUG,ELECTRICAL: SAME AS A004	EA	1	*	*	*	*	*	*	*	*	4-3	P206

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5910-284-5291	A296 CAPACITOR,FIXED,CERAMIC: FT2300 (71590)		EA	4				*	*	*	*	*	4-9	C201
P-H	5910-284-5291	A297 CAPACITOR,FIXED,CERAMIC: SAME AS A296		EA	REF				*	*	*	*	*	4-9	C202
P-H	5910-284-5291	A298 CAPACITOR,FIXED,CERAMIC: SAME AS A296		EA	REF				*	*	*	*	*	4-9	C214
P-H	5910-284-5291	A299 CAPACITOR,FIXED,CERAMIC: SAME AS A296		EA	REF				*	*	*	*	*	4-9	C221
P-H	5910-810-4852	A300 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	4				*	*	*	*	*	4-9	C203
P-H	5910-810-4852	A301 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C213
P-H	5910-810-4852	A302 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C217
P-H	5910-810-4852	A303 CAPACITOR,FIXED,CERAMIC: SAME AS A030		EA	REF				*	*	*	*	*	4-9	C219
P-H	5910-280-8393	A304 CAPACITOR,FIXED,CERAMIC SAME AS A050		EA	1				*	*	*	*	*	4-9	C206
P-H	5910-899-2538	A305 CAPACITOR,FIXED,MICA: CM15E271J (81349)		EA	1				*	*	*	*	*	4-9	C216
P-H	5910-850-0541	A306 CAPACITOR,FIXED,MICA: CM15E470J (81349)		EA	1				*	*	*	*	*	4-9	C212
P-H	5910-728-8472	A307 CAPACITOR,FIXED,PAPER: 192P10492 (56289)		EA	1				*	*	*	*	*	4-9	C204
P-H	5910-498-8670	A308 CAPACITOR,VARIABLE: 2111 (76493)		EA	1				*	*	*	*	*	4-9	C218
P-H		A309 SCREW,MACHINE: SAME AS A118		EA	1				*	*	*	*	*		H212
P-H		A310 WASHER,FLAT: SAME AS A119		EA	1				*	*	*	*	*		H213
P-H		A311 WASHER,LOCK: SAME AS A120		EA	1				*	*	*	*	*		H214
P-H		A312 NUT,PLAIN,HEX: SAME AS A121		EA	1				*	*	*	*	*		H215
P-H	5910-284-4677	A313 CAPACITOR,VARIABLE,CERAMIC: 822BNN650 (71590)		EA	2				*	*	*	*	*	4-9	C208
P-H	5910-284-4677	A314 CAPACITOR,VARIABLE,CERAMIC: SAME AS A313		EA	REF				*	*	*	*	*	4-9	C209
P-H	5910-170-3495	A315 CAPACITOR,VARIABLE,CERAMIC: 822BZNP0 (71590)		EA	2				*	*	*	*	*	4-9	C207
P-H	5910-170-3495	A316 CAPACITOR,VARIABLE,CERAMIC: SAME AS A315		EA	REF				*	*	*	*	*	4-9	C211
P-H		A317 SCREW,MACHINE: SAME AS A247		EA	1				*	*	*	*	*		H216
P-H		A318 WASHER,LOCK: SAME AS A085		EA	1				*	*	*	*	*		H217
P-H	3510	A319 WASHER,FLAT: WFN04 (06432)		EA	1				*	*	*	*	*		H218
X		A320 CHASSIS,ELECTRICAL EQUIPMENT		EA	1									4-2	MP203
P-H		A321 SCREW,MACHINE: SAME AS A118		EA	1				*	*	*	*	*		H219
P-H	5950-832-5432	A322 CHOKE,RF: R1550-37 (07886)		EA	1				*	*	*	*	*	4-9	L205
P-H	5950-060-9188	A323 CHOKE,RF: 2500-28 (99800)		EA	3				*	*	*	*	*	4-9	L206
P-H	5950-060-9188	A324 CHOKE,RF: SAME AS A323		EA	REF				*	*	*	*	*	4-9	L207

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5950-060-9188	A325 CHOKE,RF: SAME AS A323		EA	REF				*	*	*	*	*	4-9	L208
P-F	5340-809-9879	A326 CLAMP,LOOP: 831 (83330)		EA	1	*	*	*	*	*	*	*	*	4-3	MP204
P-H		A327 SCREW,MACHINE: SAME AS A253		EA	1				*	*	*	*	*		H220
P-H		A328 WASHER,LOCK: SAME AS A120		EA	1				*	*	*	*	*		H221
P-H		A329 NUT,PLAIN,HEX: SAME AS A121		EA	1				*	*	*	*	*		H222
P-H	5950-351-0393	A330 COIL,RF: AN1000-094-1 (23369)		EA	1				*	*	*	*	*	4-9	L204
P-H	5950-351-0390	A331 COIL,RF: AN1000-094-2 (23369)		EA	1				*	*	*	*	*	4-9	L203
P-H	5950-351-0391	A332 COIL,RF: AN1000-094-3 (23369)		EA	1				*	*	*	*	*	4-9	L202
P-H	5950-351-0392	A333 COIL,RF: AN1000-094-4 (23369)		EA	1				*	*	*	*	*	4-9	L201
P-H	6625	A334 COVER DUST: C1000-569 (23369)		EA	1				*	*	*	*	*	4-3	MP205
P-H		A335 SCREW,MACHINE: SAME AS A117		EA	1				*	*	*	*	*		H223
P-H	6625	A336 DIAL: B1000-571 (23369)		EA	1				*	*	*	*	*	2-2	MP206
P-H	6625	A337 DIAL,DRUM: 4030 (83330)		EA	1				*	*	*	*	*	4-3	MP207
P-H	5960-878-1889	A338 ELECTRON TUBE: SAME AS A105		EA	1				*	*	*	*	*	4-9	V201
P-H	3040	A339 EXTENSION,SHAFT: 2351 (83330)		EA	1				*	*	*	*	*	4-1	MP208
M-H		A340 FASTENER ASSEMBLY TURNLOCK: 43-99-124-41 (94222)		EA	1									2-2	MP209
P-H	5305	A341 SCREW,MACHINE: BHMS4-40X1-2 (06432)		EA	1				*	*	*	*	*		H224
P-H		A342 WASHER,FLAT: SAME AS A319		EA	1				*	*	*	*	*		H225
P-H		A343 WASHER,LOCK: SAME AS A085		EA	1				*	*	*	*	*		H226
P-H		A344 NUT,PLAIN,HEX: SAME AS A086		EA	1				*	*	*	*	*		H227
P-F	5325-840-7162	A345 GROMMET,RUBBER: 91118 (83330)		EA	1	*	*	*	*	*	*	*	*		MP210
P-H		A346 GUIDE,DIAL: A1000-746 (23369)		EA	1				*	*	*	*	*	2-2	MP211
P-H	5355	A347 KNOB: C1000-124-11 (23369)		EA	1				*	*	*	*	*	2-2	MP212
P-H		A348 SETSCREW: SAME AS A112		EA	1				*	*	*	*	*		H228
P-H	5355	A349 KNOB: C1000-124-16 (23369)		EA	1				*	*	*	*	*	2-2	MP213
P-H		A350 SETSCREW: SAME AS A114		EA	1				*	*	*	*	*		H229
P-F	6210-183-0340	A351 LIGHT,INDICATOR: SDLBBB1-680 (07137)		EA	4	*	*	*	*	*	*	*	*	2-2	DS201
P-F	6210-183-0340	A351A LIGHT,INDICATOR: SAME AS A351		EA	REF	*	*	*	*	*	*	*	*	2-2	DS202
P-F	6210-183-0340	A351B LIGHT,INDICATOR SAME AS A351		EA	REF	*	*	*	*	*	*	*	*	2-2	DS203

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-F	6210-183-0340	A351C LIGHT,INDICATOR: SAME AS A351		EA	REF	*	*	*	*	*	*	*	*	2-2	DS204
M-H		A352 PANEL,FRONT: B1000-566 (23369)		EA	1									2-2	MP214
M-H		A353 POINTER,BLOCK: A1000-086 (23369)		EA	1									2-2	MP215
P-H	5305	A354 SCREW,MACHINE: BHMS2-56X3-16 (06432)		EA	1				*	*	*	*	*		H230
P-H	5310	A355 WASHER,FLAT: WFN02 (06432)		EA	1				*	*	*	*	*		H231
P-H	3020	A356 PULLEY,GROOVE: A1001-042 (23369)		EA	1				*	*	*	*	*	4-3	MP216
P-H	3020	A357 PULLEY,GROOVE: 6057GC (23369)		EA	1				*	*	*	*	*	4-3	MP217
P-H		A358 SCREW,MACHINE: SAME AS A341		EA	1				*	*	*	*	*		H232
P-H	5330	A359 WASHER,NONMETALIC: WFNONMETN04 (06432)		EA	1				*	*	*	*	*		H233
P-H		A360 NUT,PLAIN,HEX: SAME AS A086		EA	1				*	*	*	*	*		H234
P-H		A361 PULLEY,GROOVE: SAME AS A357		EA	1				*	*	*	*	*	4-3	MP218
P-H	5305	A362 SCREW,MACHINE: FHMS4-40X1-2 (06432)		EA	1				*	*	*	*	*		H235
P-H		A363 WASHER,FLAT: SAME AS A319		EA	1				*	*	*	*	*		H236
P-H		A364 WASHER,NONMETALIC: SAME AS A359		EA	1				*	*	*	*	*		H237
P-H		A365 NUT,PLAIN,HEX: SAME AS A086		EA	1				*	*	*	*	*		H238
P-H	6625-491-0602	A366 REDUCTION DRIVE: 4511DRF (83330)		EA	1				*	*	*	*	*	2-2	MP219
P-H	5905-190-8889	A367 RESISTOR,FIXED,COMPOSITION: SAME AS A134		EA	2				*	*	*	*	*	4-9	R203
P-H	5905-190-8889	A368 RESISTOR,FIXED,COMPOSITION: SAME AS A134		EA	REF				*	*	*	*	*	4-9	R209
P-H	5905-185-8510	A369 RESISTOR,FIXED,COMPOSITION: SAME AS A141		EA	1				*	*	*	*	*	4-9	R213
P-H	5905-252-5434	A370 RESISTOR,FIXED,COMPOSITION: RC20GF121J (81349)		EA	1				*	*	*	*	*	4-9	R212
P-H	5905-190-8880	A371 RESISTOR,FIXED,COMPOSITION: RC20GF122J (81349)		EA	1				*	*	*	*	*	4-9	R207
P-H	5905-279-2616	A372 RESISTOR,FIXED,COMPOSITION: SAME AS A126		EA	1				*	*	*	*	*	4-9	R208
P-H	5905-279-1876	A373 RESISTOR,FIXED,COMPOSITION: SAME AS A158		EA	1				*	*	*	*	*	4-9	R201
P-H	5905-254-9201	A374 RESISTOR,FIXED,COMPOSITION: SAME AS A182		EA	1				*	*	*	*	*	4-9	R202
P-H	5905-195-6791	A375 RESISTOR,FIXED,COMPOSITION: RC20GF681J (81349)		EA	1				*	*	*	*	*	4-9	R204
P-H	5905-279-1719	A376 RESISTOR,FIXED,COMPOSITION: SAME AS A196		EA	1				*	*	*	*	*	4-9	R211
P-H	5905-171-1976	A377 RESISTOR,FIXED,COMPOSITION: SAME AS A198		EA	1				*	*	*	*	*	4-9	R206
M-H		A378 SHIM: A1000-562 (23369)		EA	1										MP220
P-H	5960-264-3004	A379 SHIELD,ELECTRON TUBE: TS103U02 (81349)		EA	1				*	*	*	*	*	4-9	E201

SECTION III REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
P-H	5935-160-1365	A380 SOCKET,ELECTRON TUBE: TS103P01 (81349)	EA	1				*	*	*	*	*	4-1	XV201
P-H		A381 SCREW,MACHINE: SAME AS A247	EA	1				*	*	*	*	*		H239
P-H		A382 WASHER,LOCK: SAME AS A085	EA	1				*	*	*	*	*		H240
P-H	5935-259-9853	A383 STRAP NUT,ELECTRON TUBE,SOCKET: 9SN (71785)	EA	1				*	*	*	*	*	4-1	H241
M-H		A384 SPACER,DIAL: A1000-577 (23369)	EA	1										MP221
M-H		A385 SPACER,SLEEVE: 2333 (83330)	EA	1										MP222
P-H		A386 SCREW,MACHINE: SAME AS A084	EA	1				*	*	*	*	*		H242
P-H		A387 WASHER,LOCK: SAME AS A085	EA	1				*	*	*	*	*		H243
P-H	5340-916-6535	A388 SPRING,HELICAL,EXTENSION: 6452C (72653)	EA	1				*	*	*	*	*		MP223
P-F	5930-755-4006	A389 SWITCH,ROTARY: PA2010 (71590)	EA	1	*	*	*	*	*	*	*	*	4-1	S201
P-H		A390 SCREW,MACHINE: SAME AS A084	EA	1				*	*	*	*	*		H244
P-H		A391 WASHER,LOCK: SAME AS A085	EA	1				*	*	*	*	*		H245
M-H		A392 TENSION BLOCK: A1000-745 (23369)	EA	1									4-3	MP224
P-H		A393 SCREW,MACHINE: SAME AS A118	EA	1				*	*	*	*	*		H246
P-H		A394 WASHER,LOCK: SAME AS A120	EA	1				*	*	*	*	*		H247
M-H		A395 TERMINAL BOARD: MEPNB20 (95146)	EA	1									4-1	E202
M-H		A396 TERMINAL BOARD: MEPNB9 (95146)	EA	1									4-1	E203
P-H	5940-617-2673	A397 TERMINAL,LUG: SAME AS A262	EA	1				*	*	*	*	*		E204
P-H		A398 SCREW,MACHINE: SAME AS A247	EA	1				*	*	*	*	*		H248
P-H		A399 NUT,PLAIN,HEX: SAME AS A086	EA	1				*	*	*	*	*		H249
P-H	5940-959-6520	A400 TERMINAL,LUG: SAME AS A265	EA	1				*	*	*	*	*		E205
P-H		A401 SCREW,MACHINE: SAME AS A117	EA	1				*	*	*	*	*		H250
P-H		A402 NUT,PLAIN,HEX: SAME AS A121	EA	1				*	*	*	*	*		H251
P-H	6625	A403 WINDOW,DIAL: A1000-575 (23369)	EA	1				*	*	*	*	*	2-2	MP225

SECTION IV. INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION (CONTINUED)

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5325-840-7162		MP210
5325-937-2015	2-2	MP3
5340-809-9879	4-3	MP204
5340-916-6535		MP223
5905-064-0555	4-9	R79
5905-064-0555	4-9	R106
5905-068-5720	4-7	R339
5905-079-4057	4-7	R338
5905-079-4057	4-7	R341
5905-079-7824	4-7	R334
5905-079-7824	4-7	R337
5905-171-1976	4-9	R2
5905-171-1976	4-9	R206
5905-171-2003	4-9	R65
5905-171-2004	4-9	R100
5905-185-8510	4-9	R22
5905-185-8510	4-9	R93
5905-185-8510	4-9	R213
5905-190-8865	4-9	R36
5905-190-8865	4-9	R86
5905-190-8865	4-9	R87
5905-190-8880	4-9	R207
5905-190-8889	4-9	R1
5905-190-8889	4-9	R76
5905-190-8889	4-9	R203
5905-190-8889	4-9	R209
5905-192-0390	4-9	R7
5905-192-0390	4-9	R8
5905-192-0390	4-9	R97
5905-192-0667	4-9	R27
5905-192-0667	4-9	R63
5905-192-0667	4-9	R64
5905-195-6453	4-9	R31
5905-195-6453	4-9	R105
5905-195-6453	4-9	R108
5905-195-6761	4-9	R46
5905-195-6761	4-9	R62
5905-195-6761	4-9	R88
5905-195-6761	4-9	R119
5905-195-6761	4-9	R121
5905-195-6791	4-9	R204
5905-195-6806	4-9	R28
5905-195-6806	4-9	R29
5905-195-6806	4-9	R38
5905-195-6806	4-9	R39
5905-195-6806	4-9	R101
5905-249-3656	4-9	R52
5905-249-3661	4-9	R54
5905-249-3661	4-9	R66
5905-249-3661	4-9	R84
5905-249-3661	4-9	R122
5905-252-5434	4-9	R212
5905-254-7100	4-9	R47
5905-254-9201	4-9	R99
5905-254-9201	4-9	R202
5905-279-1719	4-9	R41
5905-279-1719	4-9	R211
5905-279-1868	4-9	R91
5905-279-1876	4-9	R3
5905-279-1876	4-9	R11
5905-279-1876	4-9	R26
5905-279-1876	4-9	R71
5905-279-1876	4-9	R72
5905-279-1876	4-9	R201
5905-279-1880	4-9	R56
5905-279-1881	4-9	R89
5905-279-1890	4-9	R67
5905-279-1897	4-9	R9
5905-279-2510	4-9	R30
5905-279-2510	4-9	R37
5905-279-2510	4-9	R92
5905-279-2616	4-9	R18
5905-279-2616	4-9	R21
5905-279-2616	4-9	R74
5905-279-2616	4-9	R208
5905-279-3499	4-9	R14
5905-279-3499	4-9	R68
5905-279-3504	4-9	R4
5905-279-3504	4-9	R51
5905-279-3513	4-9	R16
5905-279-3513	4-9	R24
5905-279-3838	4-9	R107
5905-299-2040	4-9	R12
5905-299-1541	4-9	R13
5905-299-1541	4-9	R17
5905-299-1541	4-9	R23
5905-299-1971	4-9	R50
5905-299-1971	4-9	R55
5905-400-7461	4-9	R116
5905-406-9705	4-9	R57
5905-406-9705	4-9	R58
5905-406-9705	4-9	R59
5905-406-9706	4-9	R69
5905-406-9707	4-9	R49
5905-406-9708	4-9	R48
5905-406-9708	4-9	R98
5905-406-9709	4-9	R19
5905-406-9709	4-9	R81
5905-406-9709	4-9	R83
5905-406-9709	4-9	R104
5905-406-9710	4-9	R6
5905-406-9711	4-9	R96
5905-407-9712	4-9	R61
5905-407-1502	4-7	R318
5905-435-6932	4-9	R114
5905-491-4732	4-9	R103
5905-491-4732	4-9	R109
5905-713-1406	4-7	R323
5905-763-4370	4-7	R324
5905-763-4370	4-7	R326
5905-814-3815	4-9	R102
5905-937-2958	4-9	R78
5905-954-6006	4-7	R328
5905-958-3498	4-7	R331
5905-964-2219	4-9	R77
5905-978-7095	4-7	R336
5905-989-1184	4-7	R332
5905-989-1184	4-7	R333
5905-990-4196	4-7	R327
5905-990-4196	4-7	R329
5905-990-5006	4-7	R321
5905-990-5006	4-7	R322
5910-170-3495	4-9	C207
5910-170-3495	4-9	C211
5910-256-5589	4-9	C33
5910-280-8393	4-9	C15
5910-280-8393	4-9	C19
5910-280-8393	4-9	C24
5910-280-8393	4-9	C43
5910-280-8393	4-9	C44
5910-280-8393	4-9	C206
5910-284-4677	4-9	C208
5910-284-4677	4-9	C209
5910-284-5291	4-9	C201
5910-284-5291	4-9	C202
5910-284-5291	4-9	C214

SECTION IV INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION (CONTINUED)

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5910-284-5291	4-9	C221
5910-401-7320	4-9	C46
5910-498-8670	4-9	C218
5910-728-8472	4-9	C204
5910-763-6943	4-9	C26
5910-763-6943	4-9	C29
5910-765-6226	4-9	C12
5910-787-2930	4-9	C13
5910-787-2930	4-9	C16
5910-787-2930	4-9	C23
5910-787-2930	4-9	C27
5910-787-2930	4-9	C31
5910-787-2930	4-9	C36
5910-787-2930	4-9	C37
5910-787-2930	4-9	C38
5910-787-2930	4-9	C39
5910-787-2930	4-9	C42
5910-787-2930	4-9	C47
5910-787-2930	4-9	C49
5910-787-2930	4-9	C57
5910-810-4852	4-9	C2
5910-810-4852	4-9	C3
5910-810-4852	4-9	C4
5910-810-4852	4-9	C6
5910-810-4852	4-9	C7
5910-810-4852	4-9	C14
5910-810-4852	4-9	C17
5910-810-4852	4-9	C18
5910-810-4852	4-9	C21
5910-810-4852	4-9	C22
5910-810-4852	4-9	C28
5910-810-4852	4-9	C30
5910-810-4852	4-9	C32
5910-810-4852	4-9	C34
5910-810-4852	4-9	C51
5910-810-4852	4-9	C52
5910-810-4852	4-9	C53
5910-810-4852	4-9	C54
5910-810-4852	4-9	C56
5910-810-4852	4-9	C59
5910-810-4852	4-9	C203
5910-810-4852	4-9	C213
5910-810-4852	4-9	C217
5910-810-4852	4-9	C219
5910-832-5724	4-9	C11
5910-850-0541	4-9	C212
5910-850-7991	4-9	C9
5910-889-4462	4-9	C48
5910-899-2538	4-9	C216
5910-899-3799	4-9	C1
5910-899-3799	4-9	C8
5910-903-3714	4-9	C41
5930-059-8299	4-9	S2
5930-059-8299	4-9	S3
5930-059-8299	4-9	S4
5930-063-6820	4-7	S301
5930-063-6820	4-7	S302
5930-063-6820	4-7	S303
5930-063-6820	4-7	S304
5930-063-6820	4-7	S306
5930-063-6820	4-7	S307
5930-503-4270	4-9	S5
5930-755-4006	4-1	S201
5930-979-8179	4-9	S1
5935-051-5348	4-9	XV5
5935-051-5348	4-9	XV7
5935-051-5348	4-9	XV10
5935-051-5348	4-9	XV12
5935-051-5348	4-9	XV13
5935-160-1365	4-1	XV201
5935-258-2920	4-9	J7
5935-259-6981	4-3	P207
5935-259-9853	4-1	H241
5935-260-0516	4-9	XV4
5935-280-2928	4-9	J1
5935-280-2928	4-9	J3
5935-280-2928	4-9	J4
5935-280-2928	4-9	J6
5935-539-0291	4-3	P205
5935-539-0291	4-3	P206
5935-581-6400	4-9	XV1
5935-581-6400	4-9	XV2
5935-581-6400	4-9	XV3
5935-581-6400	4-9	XV6
5935-581-6400	4-9	XV8
5935-581-6400	4-9	XV9
5935-581-6400	4-9	XV11
5935-623-7199	4-9	P1
5935-623-7199	4-9	P2
5935-866-4298	4-1	XY1
5935-866-4298	4-1	XY2
5935-972-9311	4-3	J201
5940-617-2673	4-3	E3
5940-617-2673		E204
5940-959-6520		E4
5940-959-6520		E205
5950-060-9188	4-9	L206
5950-060-9188	4-9	L207
5950-060-9188	4-9	L208
5950-351-0390	4-9	L203
5950-351-0391	4-9	L202
5950-351-0392	4-9	L201
5950-351-0393	4-9	L204
5950-351-0394	4-9	L2
5950-351-0395	4-9	Z4
5950-401-7328	4-9	Z1
5950-401-7328	4-9	Z2
5950-401-7328	4-9	Z3
5950-401-7328	4-9	Z6
5950-401-7328	4-7	Z7
5950-832-5432	4-9	L205
5960-079-5079	4-9	V11
5960-082-0038	4-9	V8
5960-082-0038	4-9	V9
5960-166-7646	4-9	V4
5960-188-3602	4-9	V6
5960-256-0587	4-1	MP13
5960-262-0167	4-9	V5
5960-262-0167	4-9	V10
5960-262-0167	4-9	V12
5960-262-0167	4-9	V13
5960-264-3004	4-9	E201
5960-272-9094	4-3	E1
5960-273-2450	4-1	MP14
5960-521-9719	4-1	MP12
5960-577-1367	4-1	V1
5960-577-1367	4-9	V2
5960-577-1367	4-9	V3
5960-878-1889	4-9	V7
5960-878-1889	4-9	V201
5961-170-4430	4-9	CR1
5961-170-4430	4-9	CR2
5961-170-4430	4-9	CR4
5961-810-5463	4-9	CR3
5961-940-8568	4-9	CR5
5995-486-8335		R32

SECTION IV INDEX-FEDERAL STOCK NUMBER CROSS REFERENCE TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION (CONTINUED)

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
5995-486-8335		R33
5955-486-8335		R34
5955-486-8335		R42
5995-486-8335		R43
5995-486-8335		R44
5955-486-8335		Y1
5955-486-8335		Y2
6145-583-9268	4-3	W205A
6210-183-0340	2-2	DS201
6210-183-0340	2-2	DS202
6210-183-0340	2-2	DS203
6210-183-0340	2-2	DS204
6240-892-4420	4-9	DS1
6625-123-3131		
6625-491-0602	2-2	MP219

REFERENCE NO.	MFG. CODE	FIG. NO.	REF. DESIG. OR ITEM NO.
A1000-086	23369	2-2	MP215
A1000-204	19217	2-2	MP4
A1000-247	23369	4-9	L1
A1000-562	23369		MP220
A1000-575	23369	2-2	MP225
A1000-577	23369		MP221
A1000-745	23369	4-3	MP224
A1000-746	23369	2-2	MP211
A1000-747	23369	4-1	MP201
A1001-042	23369	4-3	MP216
A1001-488	23369	4-3	W207
A1001-489	23369	4-3	A1
A1001-490	23369	4-3	A2
BHMS-56X1-4	06432		H14
BHMS2-56X3-16	06432		H230
BHMS4-40X1-2	06432		H224
BHMS4-40X1-2	06432		H232
BHMS4-40X1-4	06432		H1
BHMS4-40X1-4	06432		H242
BHMS4-40X1-4	06432		H244
BHMS4-40X5-16	06432		H13
BHMS4-40X5-16	06432		H19
BHMS4-40X5-16	06432		H216
BHMS4-40X5-16	06432		H239
BHMS4-40X5-16	06432		H248
BHMS6-32X1-2	06432		H8
BHMS6-32X1-2	06432		H201
BHMS6-32X1-2	06432		H212
BHMS6-32X1-2	06432		H246
BHMS6-32X1-4	06432		H4
BHMS6-32X1-4	06432		H210
BHMS6-32X3-8	06432		H7
BHMS6-32X3-8	06432		H21
BHMS6-32X3-8	06432		H223
BHMS6-32X3-8	06432		H250
BHMS6-32X5-16	06432		H16
BHMS6-32X5-16	06432		H205
BHMS6-32X5-16	06432		H207
BHMS6-32X5-16	06432		H220
B1000-448-6	23369	4-7	A3
B1000-566	23369	2-2	MP214
B1000-571	23369	2-2	MP206
B1000-576	23369	4-3	MP202
CK1000-593-12	23369	4-2	W201
CK1000-593-12	23369	4-2	W206
CK1000-593-18	23369	4-3	W205
C1000-090	23369	4-3	MP10
C1000-092	23369	4-3	MP11
C1000-124-11S	23369	2-2	MP5
C1000-124-11	23369	2-2	MP212
C1000-124-16	23369	2-2	MP213
C1000-124-3	23369	2-2	MP7
C1000-124-6	23369	2-2	MP6
C1000-135	23369	4-3	MP9
C1000-564	23369	2-2	MP8
C1000-569	23369	4-3	MP205
FHMS4-40X1-2	06432		H235
FHMS6-32X5-16	06432		H12
MPENB20	95146	4-1	E202
MPENB9	95146	4-1	E203
NUTHEX2-56	06432		H15
NUTHEX4-40	06432		H3
NUTHEX4-40	06432		H20
NUTHEX4-40	06432		H227
NUTHEX4-40	06432		H234
NUTHEX4-40	06432		H238
NUTHEX4-40	06432		H249
NUTHEX6-32	06432		H11
NUTHEX6-32	06432		H22
NUTHEX6-32	06432		H23
NUTHEX6-32	06432		H204
NUTHEX6-32	06432		H215
NUTHEX6-32	06432		H222
NUTHEX6-32	06432		H251
RN65D2203F	81349	4-9	R82
RN65D3302F	81349	4-9	R112
RN65D6800F	81349	4-9	R117
RN65D6802F	81349	4-9	R111
RW55G352J	81349	4-9	R118
SSCR4-40X1-8	06432		H6
SSCR4-40X1-8	06432		H229
SSCR6-32X3-16	06432		H5
SSCR6-32X3-16	06432		H228
WFNONMETN04	06432		H233
WFNONMETN04	06432		H237
WFNONMETN06	06432		H202
WFNONMETN06	06432		H211
WFN02	06432		H231
WFN04	06432		H218
WFN04	06432		H225
WFN04	06432		H236
WFN06	06432		H9
WFN06	06432		H18
WFN06	06432		H209
WFN06	06432		H213
WLINTN04	06432		H2
WLINTN04	06432		H217
WLINTN04	06432		H226
WLINTN04	06432		H240
WLINTN04	06432		H243
WLINTN04	06432		H245
WLINTN06	06432		H10
WLINTN06	06432		H17
WLINTN06	06432		H24
WLINTN06	06432		H203
WLINTN06	06432		H206
WLINTN06	06432		H208
WLINTN06	06432		H214
WLINTN06	06432		H221
WLINTN06	06432		H247
219-14	71450	4-3	E2
219-45-003	71450		MP15
2333	83330		MP222
2351	83330	4-1	MP208
4030	83330	4-3	MP207
43-99-124-41	94222	2-2	MP209
6057GC	23369	4-3	MP217
6057GC	23369	4-3	MP218
834	83330		MP16

SECTION V INDEX-REFERENCE DESIGNATION

CROSS REFERENCE TO PAGE NUMBER

REFERENCE DESIGNATION	PAGE NUMBER
A1	C-7
A2	C-15
A3	C-6
C1	C-8
C2	C-7
C3	C-7
C4	C-7
C6	C-7
C7	C-7
C8	C-8
C9	C-7
C11	C-8
C12	C-7
C13	C-8
C14	C-7
C15	C-7
C16	C-8
C17	C-7
C18	C-7
C19	C-7
C21	C-7
C22	C-7
C23	C-8
C24	C-7
C26	C-8
C27	C-8
C28	C-7
C29	C-8
C30	C-7
C31	C-8
C32	C-7
C33	C-7
C34	C-7
C36	C-8
C37	C-8
C38	C-8
C39	C-8
C41	C-8
C42	C-8
C43	C-7
C44	C-7
C46	C-8
C47	C-8
C48	C-8
C49	C-8
C51	C-7
C52	C-7
C53	C-7
C54	C-7
C56	C-7
C57	C-8
C59	C-7
C201	C-16
C202	C-16
C203	C-16
C204	C-16
C206	C-16
C207	C-16
C208	C-16
C209	C-8
C211	C-16
C212	C-16
C213	C-16
C214	C-16
C216	C-16
C217	C-16
C218	C-16
C219	C-16
C221	C-16
CR1	C-13
CR2	C-13
CR3	C-13
CR4	C-13
CR5	C-13
DS1	C-5,C-9
DS201	C-17
DS202	C-17
DS203	C-17
DS204	C-18
E1	C-13
E2	C-14
E3	C-14
E4	C-14
E201	C-18
E202	C-19
E203	C-19
E204	C-19
E205	C-19
H1	C-8
H2	C-8
H3	C-8
H4	C-9
H5	C-9
H6	C-9
H7	C-10
H8	C-10
H9	C-10
H10	C-10
H11	C-10
H12	C-10
H13	C-14
H14	C-14
H15	C-14
H16	C-14
H17	C-14
H18	C-14
H19	C-14
H20	C-14
H21	C-14
H22	C-15
H23	C-15
H24	C-15
H201	C-15
H202	C-15
H203	C-15
H204	C-15
H205	C-15
H206	C-15
H207	C-15
H208	C-15
H209	C-15
H210	C-15
H211	C-15
H212	C-16
H213	C-16
H214	C-16
H215	C-16
H216	C-16
H217	C-16
H218	C-16
H220	C-17
H221	C-17
H222	C-17
H223	C-17
H224	C-17
H225	C-17
H226	C-17
H227	C-17
H228	C-17
H229	C-17
H230	C-18
H231	C-18
H232	C-18
H233	C-18
H234	C-18
H235	C-18
H236	C-18
H237	C-18
H238	C-18
H239	C-19
H240	C-19
H241	C-19
H242	C-19
H243	C-19
H244	C-19
H245	C-19
H246	C-19
H247	C-19
H248	C-19
H249	C-19
H250	C-19
H251	C-19
J1	C-9
J3	C-9
J4	C-9
J6	C-9
J7	C-9
J201	C-15
L1	C-8
L2	C-8
L201	C-17
L202	C-17
L203	C-17
L204	C-17
L205	C-16
L206	C-16
L207	C-16
L208	C-17
MP1	C-8
MP3	C-9
MP4	C-9
MP5	C-9
MP6	C-9
MP7	C-9
MP8	C-10
MP9	C-10
MP10	C-10
MP11	C-10
MP12	C-13
MP13	C-13
MP14	C-13
MP15	C-13
MP16	C-14
MP201	C-15

SECTION V INDEX-REFERENCE DESIGNATION CROSS REFERENCE TO PAGE NUMBER (CONTINUED)

REFERENCE DESIGNATION	PAGE NUMBER
MP202	C-15
MP203	C-16
MP204	C-17
MP205	C-17
MP206	C-17
MP207	C-17
MP208	C-17
MP209	C-17
MP210	C-17
MP211	C-17
MP212	C-17
MP213	C-17
MP214	C-18
MP215	C-18
MP216	C-18
MP217	C-18
MP218	C-18
MP219	C-18
MP220	C-18
MP221	C-19
MP222	C-19
MP223	C-19
MP224	C-19
MP225	C-19
P1	C-8
P2	C-8
P205	C-6
P206	C-15
P207	C-15
R1	C-10
R2	C-12
R3	C-11
R4	C-12
R6	C-13
R7	C-10
R8	C-10
R9	C-12
R11	C-11
R12	C-12
R13	C-11
R14	C-11
R16	C-11
R17	C-11
R18	C-11
R19	C-13
R21	C-10
R22	C-10
R23	C-11
R24	C-11
R26	C-11
R27	C-11
R28	C-10
R29	C-10
R30	C-11
R31	C-12
R32	C-9
R33	C-9
R34	C-9
R36	C-11
R37	C-11
R38	C-10
R39	C-10
R41	C-12
R42	C-9
R43	C-9
R44	C-9
R46	C-10
R47	C-12
R48	C-13
R49	C-13
R50	C-12
R51	C-12
R52	C-12
R54	C-12
R55	C-12
R56	C-11
R57	C-13
R58	C-13
R59	C-13
R61	C-13
R62	C-10
R63	C-11
R64	C-11
R65	C-10
R66	C-12
R67	C-11
R68	C-11
R69	C-13
R71	C-11
R72	C-11
R74	C-11
R76	C-10
R77	C-12
R78	C-12
R79	C-12
R81	C-13
R82	C-12
R83	C-13
R84	C-12
R86	C-11
R87	C-11
R88	C-10
R89	C-11
R91	C-11
R92	C-11
R93	C-10
R96	C-13
R97	C-11
R98	C-13
R99	C-12
R100	C-11
R101	C-10
R102	C-12
R103	C-12
R104	C-13
R105	C-12
R106	C-10
R107	C-12
R108	C-12
R109	C-12
R111	C-13
R112	C-12
R114	C-12
R116	C-12
R117	C-13
R118	C-13
R119	C-10
R121	C-10
R122	C-12
R201	C-18
R202	C-18
R203	C-18
R204	C-18
R206	C-18
R207	C-18
R208	C-18
R209	C-18
R211	C-18
R212	C-18
R213	C-18
R318	C-6
R321	C-6
R322	C-6
R323	C-6
R324	C-6
R326	C-6
R327	C-6
R328	C-6
R329	C-6
R331	C-6
R332	C-6
R333	C-6
R334	C-6
R336	C-6
R337	C-6
R338	C-6
R339	C-6
R341	C-6
S1	C-14
S2	C-14
S3	C-14
S4	C-14
S5	C-14
S201	C-19
S301	C-6
S302	C-6
S303	C-6
S304	C-6
S306	C-6
S307	C-6
V1	C-9
V2	C-9
V3	C-9
V4	C-9
V5	C-9
V6	C-9
V7	C-9
V8	C-9
V9	C-9
V10	C-9
V11	C-9
V12	C-9
V13	C-9
V201	C-17
W201	C-15
W205	C-6
W205A	C-6
W206	C-15
W207	C-15
XV1	C-14
XV2	C-14
XV3	C-14
XV4	C-13
XV5	C-13
XV6	C-14

SECTION V INDEX-REFERENCE DESIGNATION
CROSS REFERENCE TO PAGE NUMBER (CONTINUED)

REFERENCE DESIGNATION	PAGE NUMBER	REFERENCE DESIGNATION	PAGE NUMBER	REFERENCE DESIGNATION	PAGE NUMBER
XV7	C-13				
XV8	C-14				
XV9	C-14				
XV10	C-13				
XV11	C-14				
XV12	C-14				
XV13	C-14				
XV201	C-19				
XY1	C-14				
XY2	C-14				
Y1	C-9				
Y2	C-9				
Z1	C-15				
Z2	C-15				
Z3	C-15				
Z4	C-15				
Z6	C-15				
Z7	C-15				

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USASTRATCOM–SIG–GP–T (5)
USASTRATCOM–CONUS (5)
LOGCOMD (5)
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USARV (10)
USASUPCOM–CRB (5)
USASUPCOM–QN (5)
USASUPCOM–SGN (5)
USARYIS (5)
ICC (3)
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TOAD (10)
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USA Depot, Cam Rahn Bay (3)
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USA Depot, Qui Nhon (3)
USASTRATCOM Sig Gp, Japan (3)
Units org under fol TOE:
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11–15
11–45
11–97
11–98
11–158
11–302
11–303
11–347
11–357
11–367
11–377
11–500 (AA–AC)
29–118
29–134
29–136
29–137
11–368

USNG: None.

USAR: None.

For explanation of abbreviations used, see AR 310–50.

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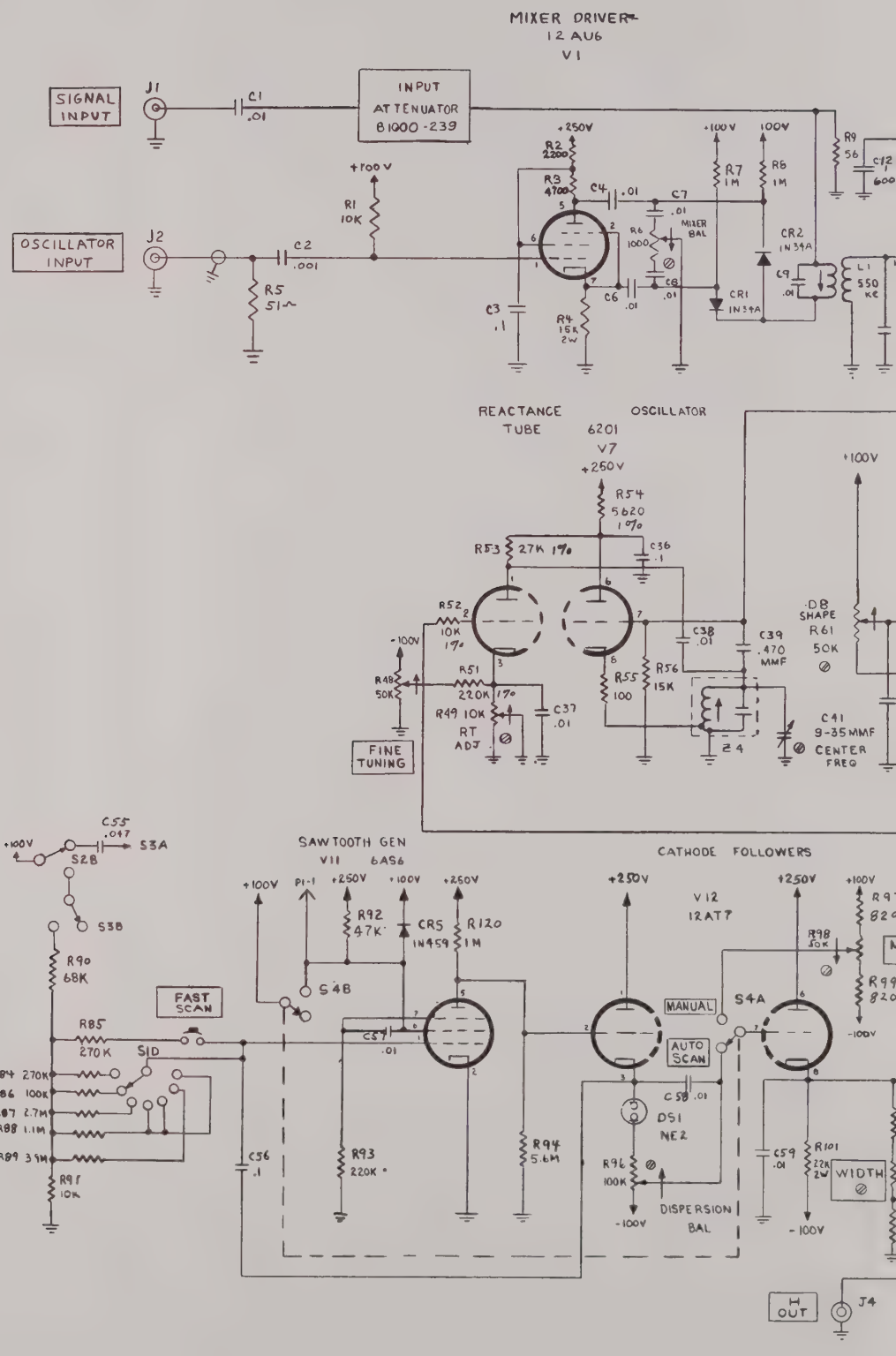
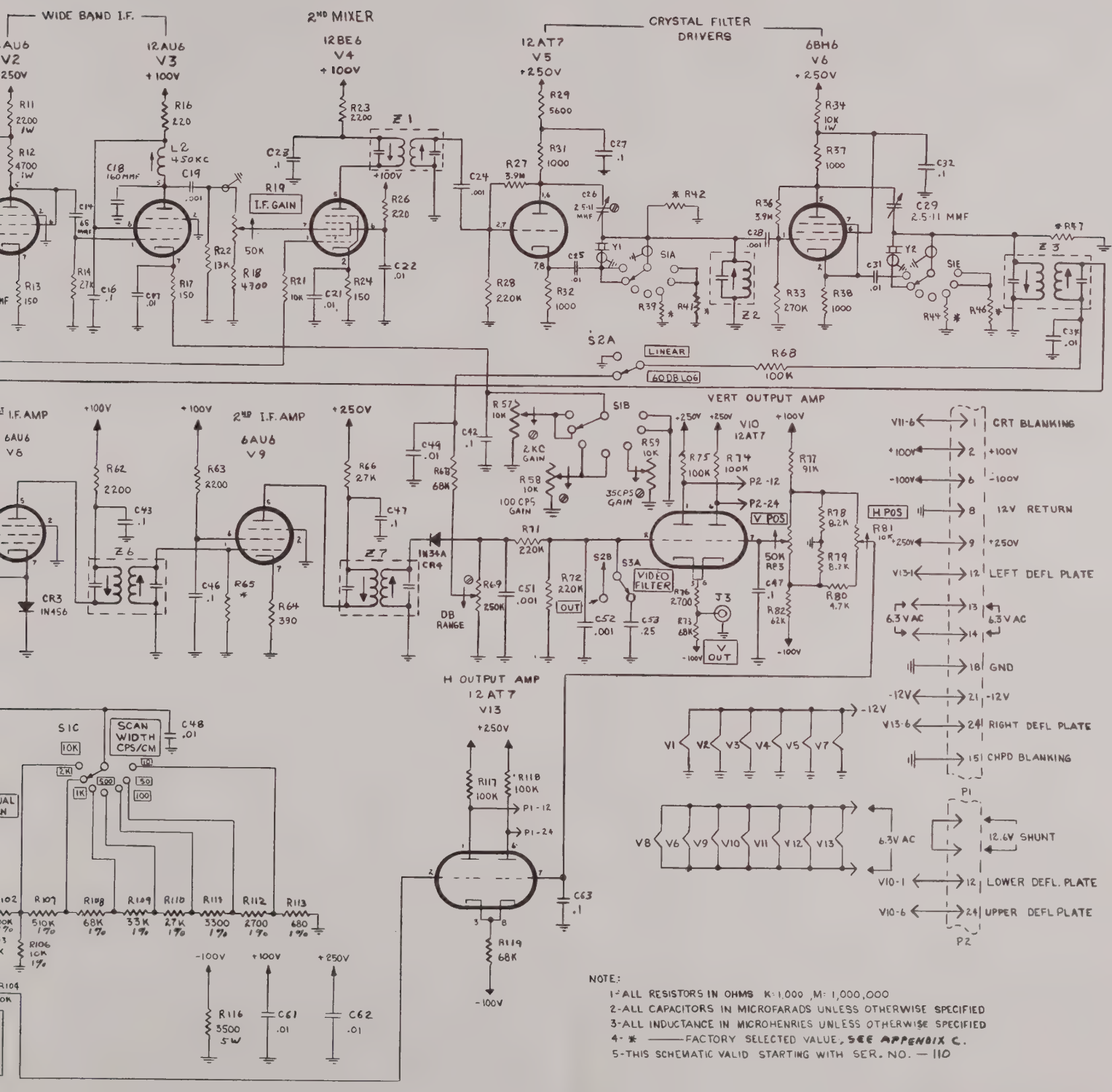
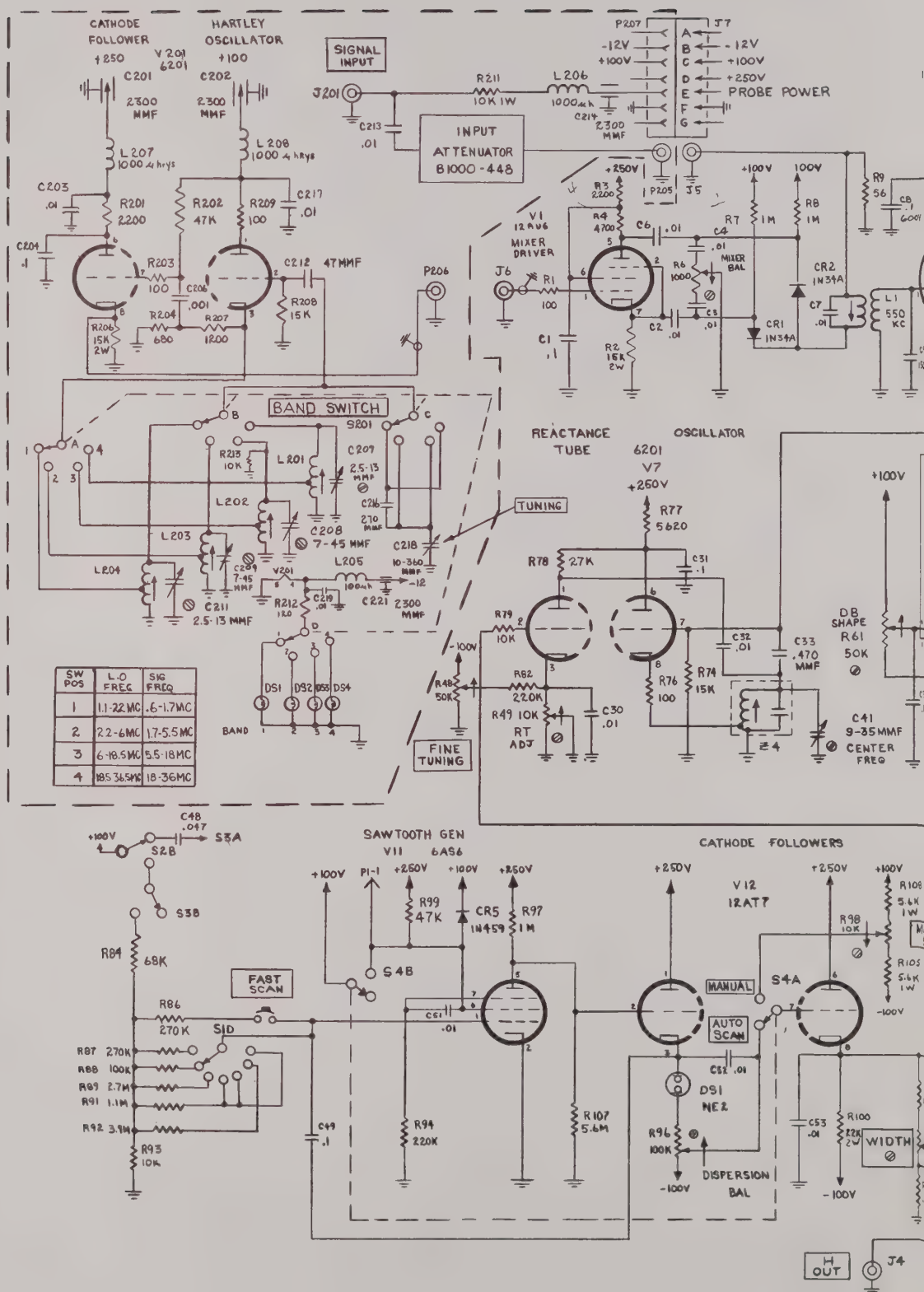

MIXER DRIVER
12 AU6
V1
SIGNAL INPUT
J1
C1 .01
INPUT ATTENUATOR B1000-239
OSCILLATOR INPUT
J2
C2 .001
R1 10K
+100V
R5 51Ω
R2 2200
+250V
R3 4700
C4 .01
C3 .1
R4 15K 2W
C7 .01
MIXER BAL
R6 1000
C8 .01
C6 .01
R7 1M
+100V
R8 1M
100V
CR2 1N34A
CR1 1N34A
C9 .01
L1 550 KC
R9 56
C12 600
REACTANCE TUBE
6201
V7
+250V
R54 5620 1%
R53 27K 1%
C36 .1
R52 10K 1%
R48 50K
-100V
R51 220K 1%
R49 10K RT ADJ
C37 .01
FINE TUNING
R55 100
R56 15K
C38 .01
C39 .470 MMF
Z4
C41 9-35 MMF CENTER FREQ
OSCILLATOR
+100V
DB SHAPE R61 50K
C55 .047
+100V
S2B
S3A
S3B
R90 68K
SAWTOOTH GEN
V11 6AS6
+100V
P1-1
+250V
+100V
+250V
R92 47K
CR5 1N459
R120 1M
S4B
FAST SCAN
R85 270K
S1D
R84 270K
R86 100K
R87 2.7M
R88 1.1M
R89 3.9M
R91 10K
C56 .1
R93 220K
C57 .01
R94 5.6M
CATHODE FOLLOWERS
+250V
V12 12AT7
+250V
+100V
R98 50K
R99 820
MANUAL
S4A
AUTO SCAN
C58 .01
DS1 NE2
R96 100K
-100V
DISPERSION BAL
C59 .01
R101 22K 2W
-100V
WIDTH
H OUT
J4



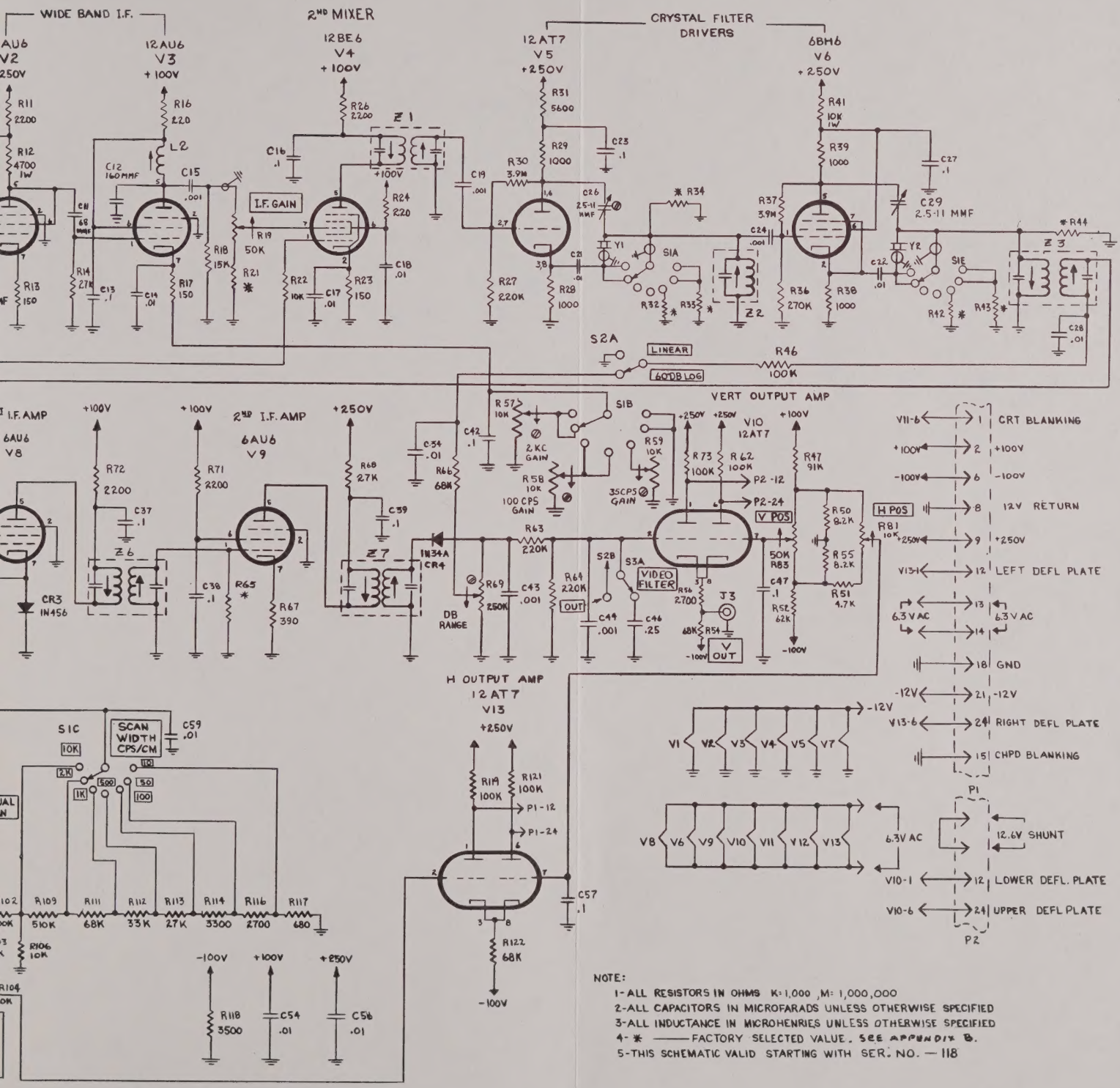
NOTE:
1-ALL RESISTORS IN OHMS K=1,000 ,M=1,000,000
2-ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE SPECIFIED
3-ALL INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
4- * ——FACTORY SELECTED VALUE, SEE APPENDIX C.
5-THIS SCHEMATIC VALID STARTING WITH SER. NO. — 110

EL6625-2461-15-TM-13

Figure 4–8. Model PSA 230, schematic diagram.


CATHODE FOLLOWER
HARTLEY OSCILLATOR
SIGNAL INPUT
INPUT ATTENUATOR B1000-448
PROBE POWER
MIXER DRIVER
BAND SWITCH
REACTANCE TUBE
OSCILLATOR
TUNING
FINE TUNING
SAWTOOTH GEN
CATHODE FOLLOWERS
FAST SCAN
MANUAL
AUTO SCAN
DISPERSION BAL
WIDTH
DB SHAPE R61 50K
C41 9-35MMF CENTER FREQ
RT ADJ
H OUT
SW POS | L-O FREQ | SIG FREQ
1 | 1.1-2.2 MC | .6-1.7 MC
2 | 2.2-6 MC | 1.7-5.5 MC
3 | 6-18.5 MC | 5.5-18 MC
4 | 18.5-36.5 MC | 18-36 MC

Fig



NOTE:
1-ALL RESISTORS IN OHMS K=1,000 ,M= 1,000,000
2-ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE SPECIFIED
3-ALL INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
4-* ——— FACTORY SELECTED VALUE. SEE APPENDIX B.
5-THIS SCHEMATIC VALID STARTING WITH SER. NO. — 118

EL6625-2461-15-TM-14

re 4–9. Model PSA 231, schematic diagram.